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AURORA BOREALIS

"THE ELECTRICAL MAGAZINE FOR EVERYBODY."

The Electrical Experimenter

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The Wireless Amateur

WE have often had occasion to feel amused at the blank astonishment of the average well informed European when he first spies the hundreds of aerials which now decorate a multitude of houses in our cities. When we inform the stranger that, according to trustworthy statistics, there are now between 350,000 and 400,000 purely amateur Wireless stations scattered all over the United States, there is no end to his wonder.

This is not surprising if we consider the fact that the United States to-day is the only country that places practically no restrictions upon the Wireless amateur. In America everybody is allowed to put up a Radio receiving station, and while a license must be obtained for sending messages the regulations are far from severe and any intelligent youth, as a rule, finds it comparatively easy to obtain the coveted license.

Now let us turn to other countries. Of course, during the war in the affected countries no amateur stations are allowed to operate, the penalties for the offenders being extremely severe and usually a long term of imprisonment is meted out to the unlucky operator.

The conditions prevailing before the war and which will presumably prevail again after peace is re-established are briefly these:

Great Britain and its dependencies: No Wireless amateur stations can be erected without the consent of the Postmaster General. In Australia, previous to the war, amateur Wireless was all but suppressed. Of England's colonies Canada probably has the greatest Wireless freedom, although a license from the Postmaster must be obtained. In Great Britain proper, it has been estimated that not more than 2,000 amateur Wireless stations prospered before the war. In France and its colonies and in Belgium the same conditions prevailed as in Great Britain. It seems, however, that the French amateurs, just previous to the outbreak of the war, engaged in a petition to the Government, pleading for greater Radio freedom. Results of the petition are unknown at this time. Of all the foreign amateurs the French are probably the most active. Before the war some 1,500 amateur Wireless stations were known to exist in France and Belgium, according to the best authorities.

In Germany, Austria-Hungary and Russia amateur Wireless is absolutely unknown. There have never been any amateur Radio stations in these countries to the best of our knowledge. The governments of the above countries are exceedingly strict in the transmission of intelligence by Radio telegraphy and no licenses are ever granted, with the exception of those to savants and to a few universities. But even here the restrictions are formidable.

The rest of the world, with the possible exception of a few South American countries where less than 200 stations flourish, measures up poorly as far as the Wireless amateur is concerned. It is believed that outside of the countries named there now exist less than 300 amateur radio stations. Outside the United States there are, therefore, considerably less than 15,000 such stations. In other words, there are in America twenty-five times as many amateur Radio stations as in the entire world. It is, indeed, a surprising result and speaks well for the enterprise of the American experimenters.

Nor can the average European understand of what earthly good the youthful Radio amateur is, for he argues correctly that not all of them can possibly become commercial operators. But he forgets that the average amateur must of needs have a higher intelligence than his card-playing, dance-hall-resorting classmate. Indeed, when your average Radio amateur has mastered all the intricacies of a Wireless set, he has obtained a pretty thorough knowledge of electricity in general. As a rule, most of our electrical industries, big and little, require thoroughly practical young men, the ones who know how to do things. This is where the amateur shines, and nine times out of ten he lands the job over the head of the notational, theoretical young man.

For this reason American parents, as a rule, encourage their son, for they know that he does not waste his time. The Wireless station seems to be a first-class investment.

H. GERNSBACK.

THE ELECTRICAL EXPERIMENTER

H. GERNSBACK EDITOR
H. W. SECOR ASSOCIATE EDITOR

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The Aurora Borealis or the Northern Lights

By H. Winfield Secor

THE Aurora Borealis, or as it is commonly known, the *Northern Lights*, constitutes one of those great scientific problems which bid fair to puzzle the keenest wits in their solution for years to come. Those of us who live in the temperate or tropical zones of the earth have probably never witnessed to any great extent, the truly indescribable and marvelously beautiful color effects, produced by the Aurora Borealis, or also by the Aurora Australis. When these spectacular effects of nature are seen in the neighborhood of the North Pole, or at least in that direction, they are known as the "Aurora Borealis." When seen in the vicinity of the South Pole or in that direction (with respect to the observer's location), they are termed the "Aurora Australis."

The word Aurora Borealis (and referring to the northern polar lights, frequently observable in the heavens), was first used by Gassendi in the year 1621, or so our science books tell us.

Up until the last century there were many wild tales published in various parts of the world with respect to the Aurora Borealis and as to what it looked like, as well as to the other physical properties manifested by this little understood phenomenon occurring in nature. It is generally conceded to-day to be an electrical discharge taking place through the highly rarefied upper atmospheric strata surrounding the earth. Although many writers have claimed that there is a distinct sound accompanying such Auroral discharges or demonstrations, it is pointed out in most reliable scientific works on the subject that there is no sound noticeable when these Auroral effects take place, or at least no sound that can be attributable directly to them. Several explorers and scientists who have studied this phenomenon closely mention distinctly that sounds have been heard simultaneously when these Auroral effects occur, but in many cases, and quite possibly in all cases, therefore, these sounds were found to emanate from such causes as the shifting of large ice fields, the continual changing of large snow deposits or other minor sources.

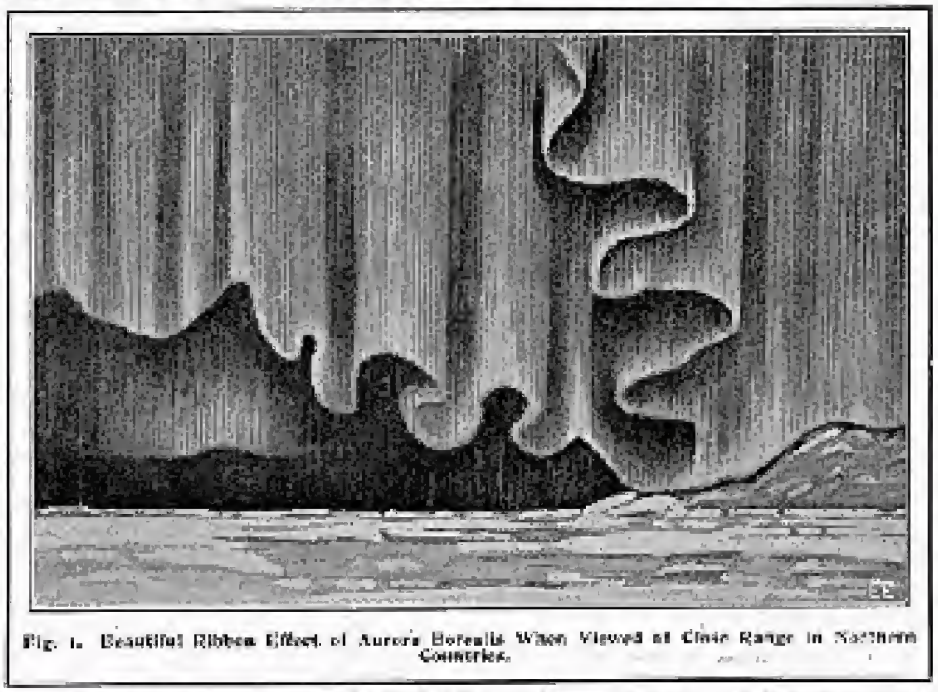

Fig. 1. Beautiful Ribbon Effect of Aurora Borealis When Viewed at Close Range in Northern Countries.

As regards the matter of any distinct odor or smell noticeable from the Aurora Borealis effect some authorities have claimed that there is discernible a distinctly irritating odor similar to that produced from "ozone," or practically speaking the same as we all have noticed after a heavy thunder storm has passed. The "ozone" in this case is due to the lightning discharges striking through the atmosphere and purifying same. Ozone is thought to be a certain form of oxygen.

Contrary to general belief the strength of the light given forth by the largest Auroras is much inferior to that of the full moon. This fact is mentioned by those who have studied the Aurora in the Northern regions at close range. Tests carried out by reading a printed page, etc., prove that generally speaking the maximum light from the Aurora Borealis rarely exceeds that of the moon in its first quarter, which is, of course, quite weak, or in other words, reading an ordinary book page was just possible. The duration of the Aurora display may be but a fraction of an hour or it sometimes exists for several hours, fascinating all the while.

The color of the Aurora Borealis is one of the least understood at the present day by the layman. In general it is usually composed of more or less vivid red, yellow and green shades. The front cover illustration, reproduced from an oil painting especially painted for the *Electrical Experimenter*, shows some of the enchanting beauties of this wonderful display produced by nature and which has been viewed only in all its magnificent pristine glory by very few men indeed, as such a worthwhile view is obtained only by making a pilgrimage to the regions adjacent to the North Pole.

The above mentioned painting is the only one in existence to our knowledge showing the Aurora Borealis in its true colors. It was originally conceived by Mr. H. Gernsback who is responsible for its accuracy; it required several weeks of careful as well as painstaking work in order to enable the talented artist, Mr. Thos. N. Wrenn, to start the painting. Several experts on the

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Aurora including Mr. Arctowsky, of New York, were executed during that time.

A good idea as to the general appearance of the Aurora is best had by quoting a few words from Alexander Von Humboldt, the famous explorer, who had the good fortune to witness a number of excellent Auroras at close range.

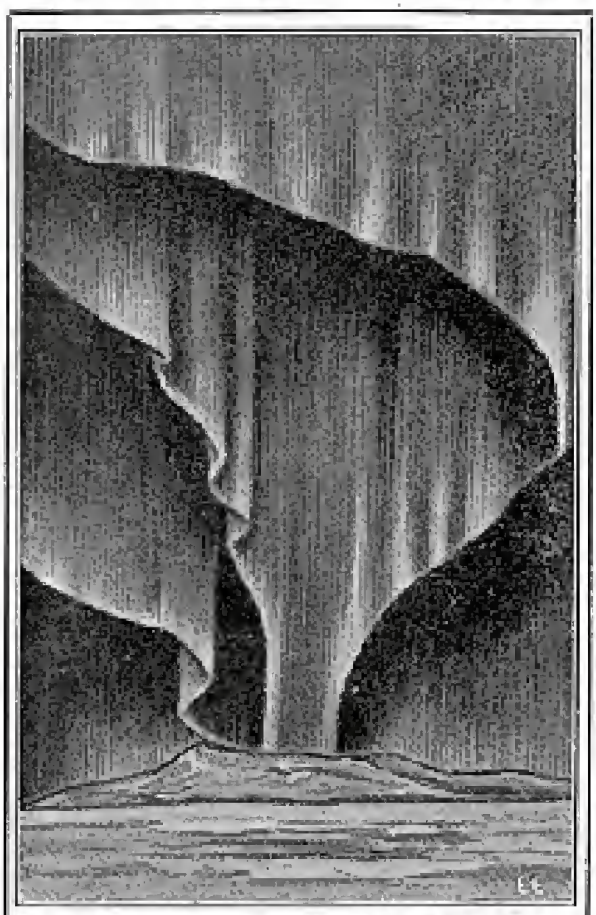


Fig. 1. The Aurora Borealis Resembles a Mighty Curtain Flapping in the Breeze.

Says this scientist, "Consider that the sky becomes at first slightly overcast and a little later a dark segment seems to form in the firmament overhead. This dark segment issues from the form of a dark shadowy cloud into a beautiful brown or violet shade. A broad, slightly luminous arch is noted, which slightly encircles the dark segment. This arch remains sometimes for hours together, flashing and kindling in a marvelous and ever varying series of undulations before rays and streamers branch out from it, shooting upward toward the zenith. The more intensive the discharge of the Northern Lights, the more bright is the play of colors, furthered by the variety graduation from violet and bluish white to green and crimson. If the observer is fortunate, as some have been, he may perchance see the most wonderful sight possible for any human, or that known as the *Crown of the Northern Lights*. This effect is caused by the rays or streamers darting upward from the curtain-like band, closing in, so as to form a *bowl* or *halo*. It is practically impossible to artificially produce or describe in words the truly magnificent effect thus attained by nature's handiwork and which probably will never be duplicated by man artificially, or at least never on any such grand scale, as occurs in the Northernmost regions of the earth, which few, indeed, ever visit."

The illustrations at Figs. 1 and 2 give a fair idea as to how the Aurora Borealis extends upwards into the sky in the form of a ribbon or waving sheet. This ribbon formation is made up of a myriad of flashes or stripes, so to speak, which are continually changing in intensity and color value, being of a bright red at their base, yellow at the center and green at the top usually. When viewed through the "spectroscope," the light of the Northern Aurora appears a vivid green and its wave length has been established to have a value of 5,570 standard units.

Sir William Ramsay, the noted English scientist, made a number of laboratory tests some time ago with various gases, notably Krypton. When electric discharges were passed through this gas, there was noted, when viewing it through a spectroscope, a *vivid green light*, similar to that produced by the Aurora Borealis, and its wave length was ascertained to be 5,570.5 standard units. On the strength of this phenomenon Sir William Ramsay believes that the Aurora seen in nature may undoubtedly be produced by electrical discharges (in the upper rarefied atmosphere of the earth) and passing through a gas in which Krypton is present to a large extent.

As regards the scientific theory covering the possible nature of the phenomenon known as the Aurora Borealis, it may be said that practically all of these now depend upon some electrical discharge action for their basis. In fact, as early as 1716, Halley, the famous astronomer, hazarded a guess that the Aurora Borealis was a magnetic phenomenon, due to the electrical charge existing on the earth and also in the air about it.

There are two principal theories now worth considering which endeavor to explain the whyfore and the where of the Aurora Borealis. One of these is that due to Prof. Birkeland, of Christiania, Norway, and the other comes from Prof. Svante Arrhenius, of Stockholm, Sweden.

To elucidate, it may be said that we have long known that *violet light rays*, and particularly the invisible rays of the ordinary spectrum beyond the violet (which are easily detected by photographic means), possess the property of discharging a negatively electrified body. It is suggested by Prof. Birkeland that the spots on the sun are caused by solar eruptions, and that the sun is then caused to give forth an extraordinary amount of negatively charged corpuscles, not unlike those which constitute the cathode rays. These rays are similar to those utilized for surgical practises in taking X-Ray pictures of the body.

Prof. Birkeland then supposes that such corpuscles are "sucked" into the earth's *magnetic poles*, giving rise to vortices or whirlpools of electric current in the upper strata of the atmosphere. As is well known, such rays can, of course, be deflected by a magnet. Also the presence of large solar or "sun spots" is invariably accompanied by powerful magnetic storms on the earth, as they are termed, and which often cause trouble on telegraph and other circuits over many widely scattered parts of our globe. Also in conjunction with these large solar spots and magnetic storms there are invariably produced very brilliant Auroræ.

Prof. Arrhenius believes that the corpuscles emitted by the sun are not inconceivably minute bodies, but that they do have an appreciable size. For instance, let us say they are 1/1,000 millimeter or 1/25,000 inch in diameter. Furthermore, that these corpuscles are expelled from the sun by the repulsive action of radiant light. Also that such radiant light is thus capable of propagating or thrusting particles out into space in spite of the enormous gravitational pull of the solar planet. This latter fact has been demonstrated a number of times in the laboratory, viz., that it is possible for light to exert a distinct force. Again, Profs. Nichols and Hull have experimentally proved and demonstrated that light does exert pressure to a very marked extent, relatively speaking, and therefore there seems to be nothing inconsistent with Arrhenius's hypothesis.

Whether we like to accept the theories of Birkeland or Arrhenius as correct or not, it does seem quite possible that negatively electrified gaseous molecules are present in the upper strata of the atmosphere surrounding the earth. Also it seems quite likely that these molecules receive their electric charge most easily where they are most exposed to a vertical sun. In other words, this would be at the equator, or nearly so. These upper aerial currents, so to speak (and according to the theory of Prof. James Thomson), will carry these and other molecules towards the earth's magnetic poles, designated as the North and South Poles, respectively. These molecular streams would move spirally northward and southward with an easterly trend. As they approach the vicinity of the magnetic poles of the earth, their number per unit area would quite obviously be greatly increased, owing to the fact that the terrestrial parallels of altitude degrees grow less in circumference, the closer they are to the "poles." It can also be expected, we are led to believe, that before the magnetic "poles" themselves are reached the potential of the upper air should increase to so marked an extent as to produce a distinctly apparent *luminous electric discharge*. This luminous discharge moreover being in the form of a ring or halo about the magnetic poles of the earth. This particular fact has been noticed by most of the explorers and investigators of the Aurora Borealis. It is this ring or

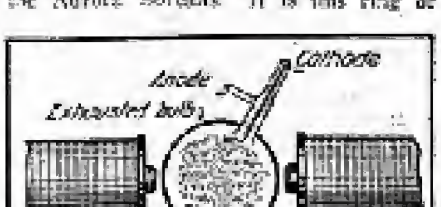


Fig. 2. Producing an Artificial "Aurora Borealis" in the Laboratory.

halo, which we see as an arch in the sky from most ordinary view points, attainable by the average observer.

Figs. 1 and 2 show this *arch effect* that some travelers in Northern regions have had the good fortune to see. These curtains of fire forming the Aurora rise upward and in the course of a short space of time they would close in so as to form a parabolic or bowl formation. Also it was noted that the axial center of this bowl formation was the magnetic pole of the

earth. A number of mathematical calculations were made in order to check this, as well as the usual observations as taken by regular explorer's instruments.

Prof. Paulsen classes the Aurorae into two divisions. Those considered in the "first class" are those which are widely extended in their formation and also quite steady. They show no streamers worth mentioning. Generally speaking, they tend to rise slowly toward the zenith, and they do not affect the magnetic or compass needle appreciably. An Aurora of this type usually appears in the form of an arch or a multitude of arches. Extended regions of the Arctic and Antarctic skies often glow with a faint light, like translucent clouds. These luminous masses are very often observed 1,000 feet above the ground.

In the "second class" in the category of Aurorae may be mentioned those characterized by streamers or very distinct rays, which may be either sharply separated or they may blend at the bottom, presenting the appearance of mighty curtains, flapping gently, now rapidly, in the breeze.

It has been noted that these rays are invariably parallel with the magnetic or compass needle and when viewed perspectively, they appear to diverge from the center of a radially striped corona. Aurorae of this class are not steady, but are traversed by a series of waves as they rise from the Northern horizon and also they deflect the compass needle to the east, but after passing the zenith they cause a westward deviation of same. From these observations, Prof. Paulsen is inclined to believe that these streamers are only rays in which negative electric charges move downward toward the earth itself.

As our illustrations indicate, the Aurora Borealis does not start from the very edge of the horizon proper, but it begins at a considerable distance above the earth. The altitude of the base of the arches formed by the *Aurora* ribbon, if we may so call it, has been measured in various ways a number of times by explorers and others making a study of the subject. From various calculations by means of trigonometry and geometry and also by measurements made direct with surveying instruments, the average altitude of the arch above the earth's surface has been found to vary from 80 to 160 miles. Perhaps the highest altitudes that have been deduced, says Alfred Angot, in his excellent work on the subject are the following: as measured by Dalton, 150 miles; Loomis, 400 to 600 miles; Bragman, 468 miles; Boshowitch, 580; Fearnley, 1,026; Twining, 1,000 miles; Beller, 1,248 miles.

The upper altitude of these arches, of course, is naturally considerably higher, depending upon the magnitude of the particular Aurora observed.

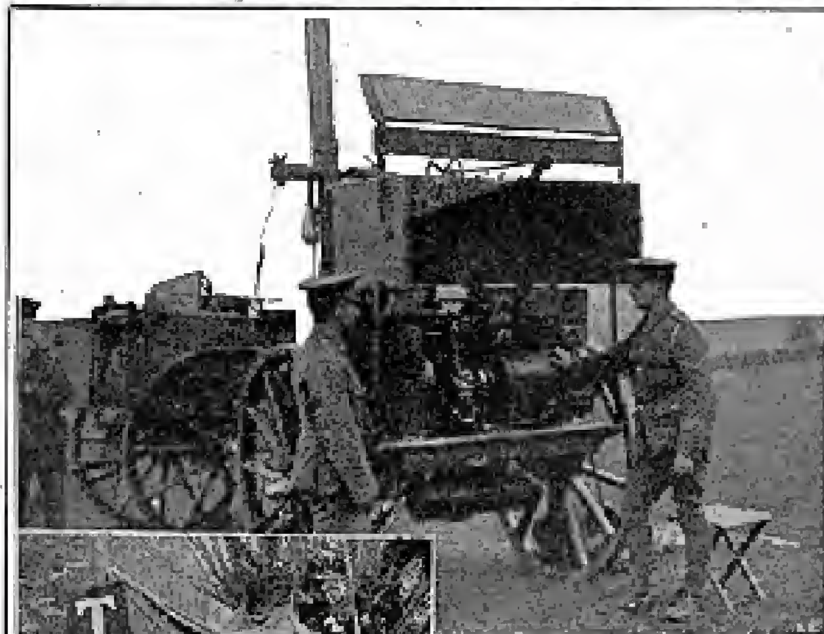
Regarding the periodicity of the Aurora Borealis it may be said that for one thing it occurs as intimated previously, with every recurrence of large sun spots. Finally and in spite of its apparent irregularity, the Aurora Borealis seems to follow a well-established routine as to its occurrence and recurrence. The periods fairly well established for its appearance may be summed up as follows:

The diurnal period, the annual period and the period of a little more than 11 years. Among the occurrence periods not exactly known, but of which the existence seems to be proven, there is one of about 26 to 30 days and another of about 55½ years. Other occurrence periods have been surmised and mentioned by different authorities and investigators, especially a period of about 229 years, but they seem rather doubtful.

[*Continued on page 300.*]

Wireless and Telephone Find Extensive Use in European Armies

Wireless telegraphy, as well as wire telegraphy and telephony, has found very extended application in the vast armies now battling over the face of Europe. It is surprising how quickly communication by telegraph, telephone or radio can be established between widely extended points of a mobile army. The telegraph and telephone wires are usually, in this case, let out from a reel carried on horseback, the horse also carrying a signal corps engineer.



Photos by Paul Thompson.

Above: Modern Wireless "Cart" Set in Use by British Army in the Present Titanic European Conflict.

Below: German "Telephone" Station in One of Advanced Posts in France.

It goes without saying that if it were not for the rapid and far-reaching means of communication now available, thanks to electricity, the rapid movement of troops could never be attempted with the success now attending such manoeuvres under actual battle conditions, as demonstrated time and again by the Germans as well as by the Allies' forces.

Our first photograph shows a modern wireless "cart" set as used in the British army. These sets are very compact and can be unpacked and set up, ready for operation in transmitting radiograms over stations of several hundred miles, in a few minutes' time.

An oil or a gasoline engine is usually employed to drive an alternating current generator, and the transformers in the radio transmitting set are thus supplied with current. These sets, as here shown, are usually rated at 1½ to 2 kw. and utilize a collapsible steel or wooden mast having a total height of 30 to 80 feet.

The second illustration shows the field "wire" telephone apparatus in actual use by the signal corps of the German army. This particular photograph was taken at one of the outlying advance posts of the German army near the Aisne. These telephone stations are indicated by a large letter "T" hung on the tree, as perceived. This is for the guidance only, of course, of members of the local regiment to which the instruments belong.

As may be seen, the apparatus is quite heavy in its make-up, and it is extremely necessary that such apparatus shall be very rugged, so as to withstand the severe wear and tear of military requirements.

EXPORTERS ARE TOLD TO USE WIRELESS.

The American State Department, through the Atlanta Chamber of Commerce, recently notified Southern exporters to handle their foreign communications by wireless telegraphy to avoid the strict censorship which the belligerent nations have maintained on all cablegrams from the United States since the outbreak of the war.

This information was sent from Washington by Second Assistant Secretary of State Alvey A. Adee, following a protest from the chamber recently that a number of Atlanta exporting houses had been unable to communicate with their foreign agents on commercial matters by cablegram.

It has been advised by the State Department that the Postal Telegraph lines be used when wireless messages are sent via the Sayville radio station, and that the Western Union wires be used in the transmission of air messages from the Tuckerton radio station.

We want to buy May, '13, Oct., '13, and Jan., '14, copies "E. E." Address the Editor.

Baron Münchhausen's New Scientific Adventures

By Hugo Gernsback

Münchhausen Departs for the Planet Mars

ONCE upon a time a grouchy old gentleman with a grievance for fiction writers, presumably because the latter received more emoluments for their stuff than the former for his poetry, thus vented his resentment in immortal song:

"*'Tis strange, but true; for truth is always strange—stranger than fiction.*"

From this some coarse soul, totally oblivious of any poetic infection whatsoever, took it upon himself to mutilate the above passage of one of Lord Byron's poems and taught us unsuspecting mortals to hawk, parrot-wise, ever after until the end of fiction, thusly: "Truth is stranger than fiction!".

With all due regard to the memory and genius of Byron, I, I. M. Alier, a citizen of a free country, take it upon myself to correct his Lordship at this late and quarrelsome date, to wit:

"*There is no fiction.*"

If, as often—no, always—has been proved that the most violent fiction at some time or other, invariably comes true, then by all precepts of modern logic, there cannot be such a thing as fiction. It simply does not exist. This brings us face to face with the startling result: that if fiction always comes true some time or other, why then, bless their dear souls, all fiction writers must be prophets!! Hurrah for the F. W.!! But hold on, boys; don't let our enthusiasm run away with us as on a Ford. The spark plug has run afoul somewhere. While it's nice to be a prophet, don't you forget that a prophet is never, never recognized in his own country. Thus the New Testament teaches; so I think it will be safer for all F. W. to remain F. W., rather than to be honorless prophets.

However, that is not what I had in mind when I started—it's so hard for me to say what I mean, and a good deal harder for me to keep my thoughts running on the track. They ramble from one nothingness into another. My mind in that respect is a good deal like a one-eyed, religious old cow on a pasture. She eats up whatever she sees alongside of her, but when she finally turns around she perceives with astonishment that there is still a whole lot to graze on the other side; so she steers around to starboard and returns to her original starting point.

But I am rambling again. So let's return to the original starting point.

Seriously speaking, and by way of emphasizing how much stranger truth is than fiction, I have but to point to Jules Verne's famous stories. When 45 years ago he wrote "*Twenty Thousand Leagues Under the Sea*" no one took him serious. It is doubtful whether he himself believed that the submarine which he invented in that story would ever become practical. It was just fiction. Yet 45 years later we see how a submarine, almost exactly as his vivid as well as prophetic mind conceived it, down to the most minute detail, emerges from a German harbor and travels under its own power over a distance of 4,000 miles, through the North Sea, the English Channel, down the Atlantic, through the entire length of the Mediterranean and up through the Dardanelles to Constantinople! And by way of diversion it manages to sink several battleships of the enemy by means of its torpedoes. Now, bold as he was, Jules Verne never conceived such an "impossible thing," and while his famous *Nautilus* was equipped with almost every other modern submarine necessity, the infernal automobile-torpedo was missing. Truth is indeed very much stranger than fiction. Hundreds of similar instances could be cited, but lack of space prohibits it; besides, I mustn't ramble!*

Münchhausen, as will be remembered, had explained the mysteries of the moon to me, and he had also mentioned the great danger of falling meteors, which had been increasing alarmingly in number for some time. The moon's attenuated atmosphere offered no protection from meteors, as did the earth's thick air. But few meteors ever reach the surface of the earth; the colossal friction between the meteor and the air ignites the former and most of it falls down on the earth as a fine dust. The burning of the meteors represents the shooting stars we see. On the moon, however, the meteors crash down bodily, causing tremendous havoc, and this terrible bombardment goes on forever without letup! Consequently, when Baron Münchhausen stopped short that evening in the midst of a sentence, I naturally was alarmed not a little. Great, therefore, was my joy when, sitting before my radio set the next evening, 'phones clapped tight over my ears, my eyes glued on the clock, the familiar high, whining spark suddenly reverberated in my ears at the stroke of 11 o'clock.

It was Münchhausen. But his usual sonorous voice to-night had an unfamiliar metallic timbre that puzzled me greatly; in a short time, however, the mystery was cleared, and this is what poured in my astonished ears:

"My dear Alier. No doubt you thought I had been killed by a meteor last night. Well, as you Americans put it, I had indeed 'a close shave.' A meteor crashed down on my aerial 50 feet from where I was sitting; it of course went up in smoke—metal vapor, to be correct—due to the tremendous heat generated by the impact of the meteor on the granite rocks. The whole meteor itself went up in a fiery cloud of red vapor and I was blown headlong a distance of over 50 feet, right down into the mouth of a giant crater, by the colossal resulting blast of the concussion.

"Now, this long-extinct crater is a very deep one; how deep I was soon to learn! I went down head first and kept on falling at a terrible rate of speed. I must have been falling down that awful abyss what seemed to me like hours. As I kept on plunging down I was gloomily reflecting what an inglorious death it was to die down at the bottom of an interplanetic crater on a dead and dried-up moon. I thought of many things, when I suddenly became conscious of a terrific cold. Call it instinct or presence of mind, as soon as I had started on my downward journey I had jerked my body in such a manner as to frighten it; in other words, after a few attempts I succeeded in falling feet down. It was indeed a fortunate circumstance that the sun was almost directly overhead the crater, for it saved me the anguish of plunging down into a pitch-black abyss. While it was of course not as light as at the top, still I could see where I was falling, and that was at least some consolation. Thus, when I glanced down in the direction of my feet after a while, I am sure that my heart, which had stopped beating, stood still entirely for some seconds. It took me a few seconds to collect my bewildered senses, for this is what I had seen:

"*The crater had no bottom at all*, but went right through to the center of the moon, where it connected with another crater, *which went to the opposite side of the moon.* I knew this must be so because when I had looked down I had seen several stars shining through brilliantly *from the night side of the moon.* Then the awful truth flashed through me and I almost swooned. *I was falling through the whole length of the moon!* I had been in many tight quarters before during my somewhat exciting career, but this experience indeed took well to be the inglorious end of my adventurous life. However, my far-famed presence of mind and my cool head soon asserted themselves, as was naturally to be expected of me.

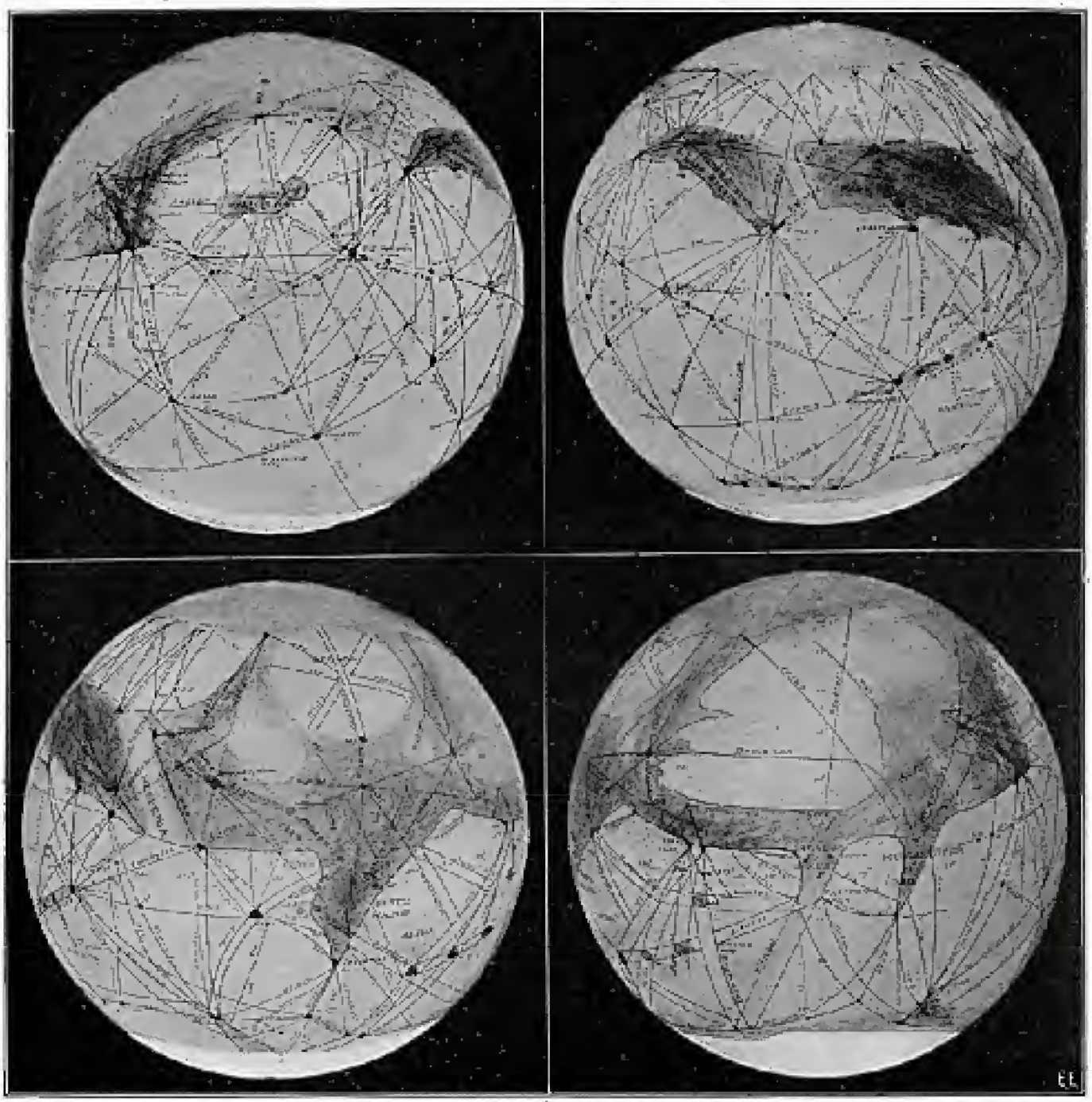
"I know the diameter of the moon to be

"THERE *are more things in heaven and earth, Horatio, than are dreamt of in your philosophy.*" So sings Shakespeare. One of these "things in heaven" is the Planet Mars, the most fascinating, the most astounding revelation to the feeble human intelligence. Shakespeare, the master of the drama, never conceived anything like a drama of an entire world—millions of intelligent beings—fighting a heroic battle, a battle for existence. Yet this drama was going on right before his very eyes, but 35 million miles away; for the Martians have been fighting for water ages ago, and the available supply becomes smaller each year.

There is nothing more inspiring, nothing more gripping to the imagination, than this wonderful battle between organized intelligence on one side and unrelenting nature on the other.

Mr. Münchhausen's scientific lecture gives you the latest facts—now almost universally believed—about Mars. You can spend no better half hour than turning your mind from your humdrum existence towards a subject which is as absorbing as it is lofty in its grandeur.

*In order to distinguish facts from fiction in this installment, all statements embodying actual scientific facts will be enclosed between two * marks.—Author.



Four different views of the planet Mars. As Mars turns on its axis once every 24 hours the same as the earth, we are enabled to see the entire surface of the Martian globe during that time. The four views, as shown, are therefore taken six hours apart from each other. These pictures were made during the last "opposition" in 1913, when Mars was some 47 million miles distant from the earth. It never comes nearer than 35 million miles to the earth. In 1924 the two planets will be but 25 million miles apart. In the views shown the top is north, the bottom south, for through the telescope all objects are turned upside down. The white patch at the bottom is the north polar snow cap, the southern cap is not in evidence for it has melted already. The melted water has been conducted equatorward by the "canals." Note that the canals run through the dark areas, which are not oceans therefore, but land with vegetation. The light areas are deserts. Nearly all canals are perfectly straight, the even ones, the edges of the pictures appear curved only because we are looking on a globe and not on a plane surface.

Photos courtesy of Prof. Percival Lowell, Flagstaff Observatory, Flagstaff, Ariz.

2,161 miles. A quick mental calculation proved that it would take my falling body about 24 minutes to reach the center of the moon. As there was nothing to stop my fall, I must naturally continue to fall, due to the tremendous momentum acquired, till my body would *almost* emerge at the opposite side of the moon at the mouth of the other crater. At this point my speed would be zero and I would have fallen for 48 minutes. If I could not manage then to grasp a projecting rock I would continue to fall back again toward the center of the moon. I reasoned that once more my momentum would carry me past the center and I would then be *almost* carried to the mouth of the opposite crater—my original starting point.

"I say almost, for the friction of my body against the air would tend to retard my fall. If at this point, where my speed was again zero, I could not succeed in taking hold of a projecting rock of the crater's side I would begin to fall down once more, the same as before. I would then continue falling back and forward exactly like a bouncing ball, each time, however—just like a rubber ball—a little less than on the previous plunge. Thus my steps would become of shorter and shorter duration, and finally I would fall no more.

"As I had ascertained before, the sun was almost overhead, shining down into the crater. I also remembered that it was almost exactly 12 o'clock midnight, terrestrial time, when the meteor smashed my aerial; this, then, was the time I started on my remarkable journey into the bowels of the moon. With a tremendous effort I pulled out my chronometer and noted that it was 12:23 a. m. In another minute I would fly past the center of the moon. Looking about, I saw in the uncertain light that I went whizzing through an immense hollow, proving to me that the center of the moon was far from solid, due no doubt to the centrifugal force of the moon at the time when it had not solidified, some millions of years ago. I estimated later that the moon was an immense hollow sphere with a solid crust about 500 miles thick. By way of a homely comparison, the moon therefore must be a hollow globe

like a rubber ball. Like the latter, it is filled inside with air, while its crust can be compared to the rubber of the ball.

"In another minute I had passed the center and was now dropping toward the other side of the moon. If I continued falling in my present position I must naturally emerge at the opposite side with my feet toward the sky, as a little reflection will reveal to you. So once more I jerked my body about, and I was now falling 'up,' with my head at the top, my feet pointing to the sun. At the end of another 24 minutes I could feel my body slowing up from the terrific speed. As the crater at this side of the moon was fortunately rather narrow, I found little difficulty in reaching for a projecting rock as soon as my plunge had come to a dead stop. I held on for dear life and clambered up a narrow ledge, where I fell down exhausted and panting from my dreadful experience.

"My sensations in falling through 2,164 miles of space, going over 10 miles per second at the center of the moon, you would, of course, like to know. Well, the first minute it is rather unpleasant. Highly so. The place where your stomach should be by right is one vast area of nausea. But once you become accustomed to it it becomes bearable, for there is nothing else to do. You might think that the rush of air would kill you in a few seconds, or else draw all the air out of your lungs, thus asphyxiating you. Neither is the case, for the air is so thin on the moon that the rush is not so terrific as it would be on earth. Also, by keeping the mouth tightly shut and breathing—with difficulty, it is true, through the nose—one does not die in 48 minutes. The friction of the air against my body did not ignite the latter either, with a consequent burning of my dear self. For, as I told you some time ago, the temperature inside of the moon is near the absolute zero, the awful cold of the stellar world. But neither did I freeze to death, for the simple reason that the friction of my body through the attenuated air was just sufficient to heat me up enough so as to keep me comfortable. Thus you see that if it had not been so cold I would have burned up; and vice versa, if the friction of the air against my body had not heated it, I would have frozen to death long before reaching the crater of the moon. Then, too, another important point to consider is that on the moon, as explained previously, my body weighed but 27 pounds against 170 pounds on earth.* This is, of course, a rather small weight, and for that reason my fall was not so terrible as if my body had weighed 170 pounds, as on earth. For that reason, too, I was not attracted so much to the sides of the crater as I would have been if my weight had been greater. Also it was fortunate that the two craters widened out considerably the further down they went into the moon's interior. As a matter of fact, the 'hole' of each crater at no point was less than three miles in diameter. This was indeed very lucky for me, for the following reason:

†"If we drop a stone in a very deep and narrow shaft, as has been shown experimentally on earth, this stone will never reach the bottom. Instead, it will bury *itself into the eastern wall* of the shaft long before reaching bottom, providing the shaft is deep enough. The explanation is that the earth rotates on its axis from west to east at a speed of 1,524 feet per second at the equator. Thus it is apparent that the earth revolves quicker than the stone can fall in a few seconds.* It therefore intercepts the stone's flight, with the result that the stone must of necessity strike the eastern wall of the shaft. This phenomenon is termed 'the falling of a body toward east.'†

"Now, precisely the same condition exists on the moon, of course. Fortunately, I started falling at the western side of the crater, but as the latter was so wide I never came near enough to its eastern wall to hit it. Likewise the other crater, at the opposite side of the moon, measured some four miles in diameter and, while I finally did reach the eastern wall, my flight had come to an end as explained already. Indeed, nature favored me all through, for the moon rotates with a velocity of but 15½ feet per second at its equator, against a like speed of 1,524 feet of the earth. For this reason there was no danger that my body would collide with the sides of the crater somewhere in the interior of the moon, for my flight was far more rapid than the speed of the moon's rotation on its axis.

"But in the meanwhile my troubles were far from being terminated. No sooner had I regained my breath than I became conscious of the terrible cold; for I was now but a few feet from the surface of the moon, but on that side which was turned away from the sun, where nothing but icy cold, darkness and desolation reign. Aside from this, I was some 2,160 miles away from Flitternix, my companion, and our 'Interstellar.' Walking around half of the moon was out of the question; neither could I stay where I was without freezing to death. So I climbed up to the surface of the moon with considerable effort. Then by aid of the starlight I ran rapidly around to the western side of the crater, for I had to run in order to keep warm. After having obtained my bearings by aid of the stellar constellations, to make sure that I was at the western side of the crater, I took a deep breath, looked down in the abyss through which the sun was shining from the other side, and dived head down into space once more.

"You see, I had reasoned that it was far better to attempt the flying journey through the moon once more than to perish with the cold on the dark side of the moon. Besides, I had experience now and, having been successful once, it was natural for me to expect success again. I had nothing whatever to lose, but everything to gain.

"My first experience was repeated without any incident; furthermore, I calculated that I should land at the eastern wall of the far crater within 48 minutes if everything ran smoothly. But I had left our good old sun out of my calculations. You see, the gravitational attraction of the sun controlled the fall of my body in the same proportion as it controls the rotation of the moon and the earth, as well as the other planets. I mentioned how in my former flight I had risen to the top of the moon; as a matter of fact, somewhat higher, for the opening of this crater was higher than the surface of the moon. But now I was falling *toward* the sun, and the sun was aiding as well as accelerating my flight; for I moved constantly nearer to it.

"For this reason at the end of 48 minutes I did not strike the eastern end of the crater. Instead I whizzed right past the eastern wall, almost brushing it, and continued to rise up into the air about 100 feet before my speed was spent. I promptly prepared myself to plunge down into the crater again. Indeed, before I realized it I had begun to fall down once more when the unexpected happened.

"I suddenly felt a rope encircling my body, and before I had time to think I was jerked sideways, and in another second I had fallen on a heap of sand and looked with astonishment into Professor Flitternix's eyes, who stood over me grinning sheepishly!

"This is what happened: Flitternix had, of course, seen me fall into the crater, and as he had rushed to the edge he had seen how I dropped down at lightning speed. Looking closer, he also noticed what I saw, namely, that the crater went right through the entire diameter of the moon, for he could see the stars shining through from the other end. He was loath to believe that the fall would kill me, and, as a scientist of note, he calculated exactly in advance what was likely to happen to me. He reflected that it would take me some two hours to make the round trip, as he knew that I could not possibly stay at the other side of the moon. He reasoned, correctly, that in case I was not killed I would come swinging through the crater in due time. Unperturbed as he is by such mere details, he went to the 'Interstellar' and had his lunch. Within two hours he returned to the crater, armed with a telescope and a long rope. It did not take him long to locate me down in the abyss by means of his glass, for I was rapidly coming to the surface then. Attaching one end of the rope to a near-by rock, he fashioned a sliding noose on the other side and waited.

"Now it must be said to the credit of Flitternix that in his younger days he had lived in the West on a ranch, and there had become an expert in the science of lassoing. He boasted that once he lassoed a common sparrow by its left hind leg, but this I believe to be somewhat exaggerated. Be that as it may, when I finally emerged to the surface, a living piece of lava ejected out of an extinct crater, Flitternix had but little trouble in lassoing me as I came whizzing up. Whereupon I thanked him and asked him if lunch was ready, for the trip had given me quite an appetite, as you may well imagine. Luncheon over, we decided right then and there to quit the moon, for Flitternix as well as myself were of the opinion that there was little further to be

(*Continued on page 297.*)

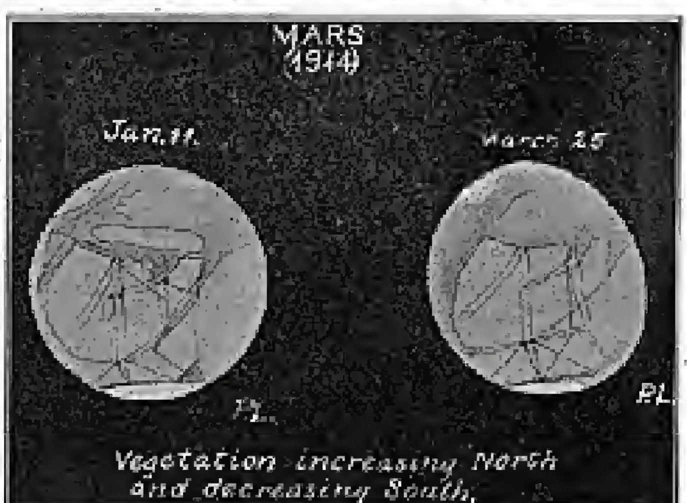


Photo by Lowell Observatory.

*An object weighing 1 lb. on Earth weighs 0.167 lb. on the Moon.†

*The speed of a falling body at the surface of the earth after the first second is 16 1/12 feet. In 6 seconds a stone would have traveled but 579.†

The Gravitation Nullifier

Ned Cawthorne, Millionaire, "Floats" a New Issue, but Not of Bonds

By George Frederic Stratton

THE gigantic mogul, No. 78, had been held on a siding on the Santa Fe Railroad waiting for three troop trains to pass on their rush to the Rio Grande. Behind her were 40 empties which she was hauling back to be reloaded with munitions and supplies and again to be rushed to the front.

Blakely, the engineer, who had been 19 hours on the run and saw no relief until he reached Los Lunas, was doggedly morose, for his orders were coming from dapper second lieutenants or curt, brusque majors, instead of through smiling station agents with their crisp telegrams. At last he got his signal and viciously pulled his throttle. There was a furious rush and while of the 12-coupled drivers but no headway.

He instinctively shut off steam, turned on the sand and again slowly and cautiously opened the throttle with the same result—a whirl of the drivers as if they were the wheels of a child's wagon, spinning in the air.

"Grease?" grunted the fireman.

"There'll be a grease-spot if I catch any blamed fools playin' tricks 'round here!" howled Blakely as he sprang from the cab.

But he found nothing wrong. The rails were dry and in perfect condition; and with a lowering puzzled look he climbed back into the cab, threw over the reversing lever and opened the throttle. There was not the slightest impulse backward or forward.

The sharp exhaust cut out the explosion of picturesque idiom and expletive from Blakely. Then he yelled to the conductor who had come forward: "Cut her loose, Hank!"

The mogul was uncoupled and again the engineer gave her steam and his puzzle became a miracle. The great locomotive started forward with a plunge which threw the fireman back on the coal; the forward trucks sprang clear of the rails and a sharp gust of wind sweeping down the arroya lifted the huge machine into the air and floated it across the main track. Then it settled down in the sagebrush so gently as not to displace one chunk of coal.

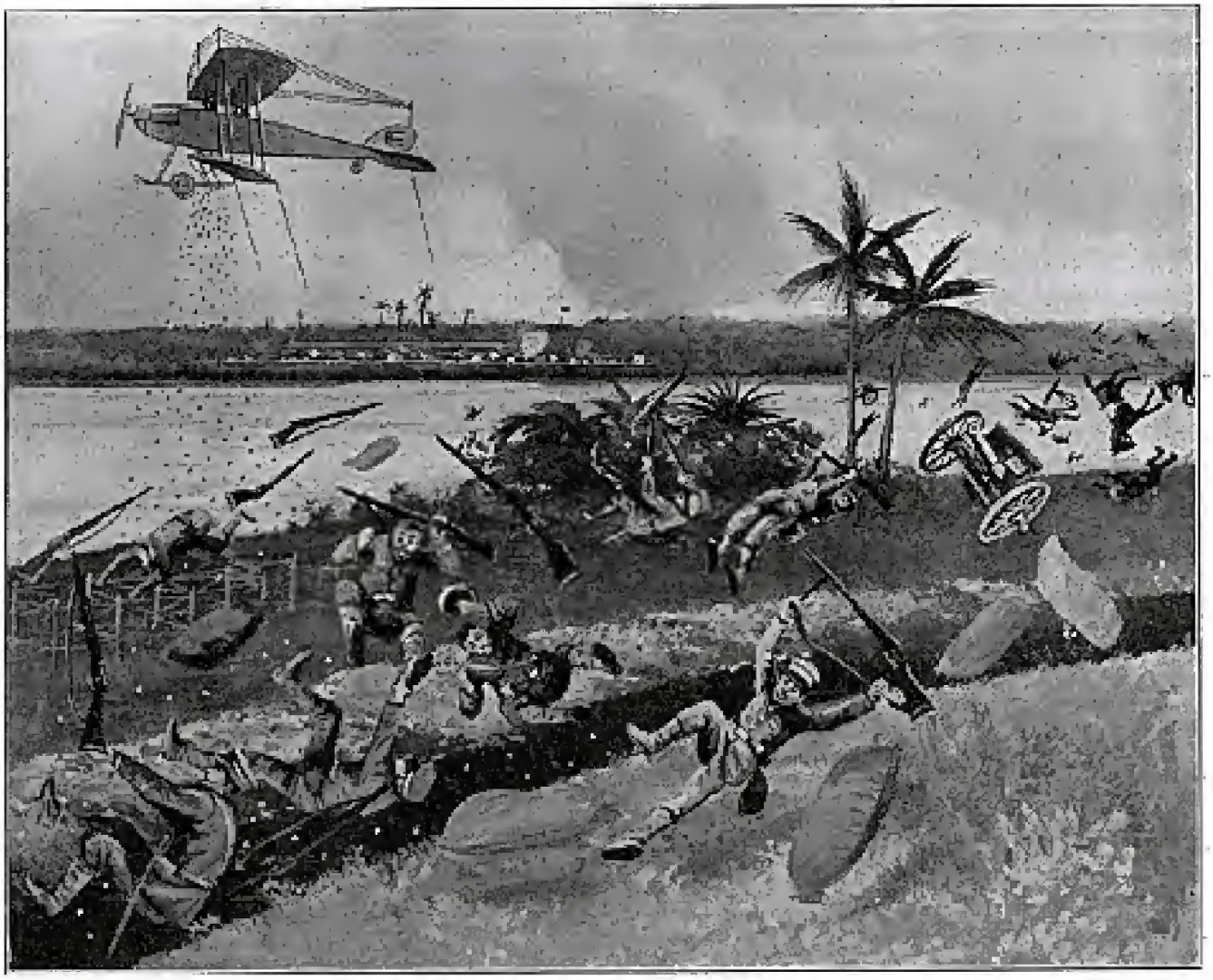
Blakely slumped back on his seat, aghast, and the tan on his corrugated cheeks and forehead faded off to a sickly ashen gray. The fireman sprang from the cab, his hair standing on end, but instead of his feet reaching the ground the breeze caught him and wafted him along as though he was thistle down. Fifty yards away he drifted against the telegraph wires and clung to them convulsively. Grouped between him and the engine were the train crew and station helpers, staring in bewildered terror, and a few yards behind them stood a man, dressed in gray, waving what looked like a pocket searchlight, in signals to a biplane, far overhead.

A cavalry lieutenant with a squad of troops galloped round the station and down the track, halting as they reached the man in gray.

"What does this mean, sir? What aeroplane is that, and why are you signaling? Who are you?"

"My name is Cawthorne," smiled the other. "I'm interested in a new device for suspending gravitation, and that biplane is operating it." He turned to the fireman in the wires and shouted: "Step off at the first lift of the wind. You'll settle down, all right."

The lieutenant spurred close to him. "I suppose you know that the road is under martial law and that you're interfering with its operation. You're under arrest, sir!"



". . . . Thousands of Men Were Wriggling in the Air, Mixed Up with Machine Guns, Mortars and Small Arms."

"Certainly," grinned Cawthorne. "Now, perhaps you'll allow me to put that locomotive again into commission."

He stepped over to the great engine, followed by the officer and his squad, and placing one hand under the cowcatcher lifted the entire front of the locomotive clear of the sagebrush.

"Gravity entirely gone!" he laughed. "Call on two or three of those men to help and we'll put this back on the track in a moment. Then we'll restore its weight and it can go ahead."

The officer scowled and hesitated. Then he ordered four troopers to dismount and help. Two minutes later they had carried it over to the head of the train. As they did so, Cawthorne again signaled the biplane. Then he stepped to the cowcatcher and heaved on it.

"Weight's all back, lieutenant! Now I'm at your service."

Two hours afterwards Cawthorne, escorted by the cavalry squad, arrived at the headquarters of the Fifth Brigade and was immediately taken before General Illington. That grizzly old warrior scrutinized him keenly; then growled:

"You are Mr. Cawthorne—Edward Cawthorne, I am informed."

Ned bowed. The general smiled grimly and continued:

"The man who devised those submarines that have been putting the Jap dreadnaughts to sleep?"

"I am the man who financed them, general. The deviser is a man named Wheaton, of Providence."

"Very effective, sir; whoever did it. But ——," and a scowl darkened his rugged face, "that is no excuse for experimenting on our battle line. Nothing can be an excuse for that, sir!"

"It was not experiment, general; but demonstration. Shall I explain?"

"I will listen to you, sir, but I warn you that no explanation can relieve you of the consequences of your action. You delayed that freight train for nearly ten minutes—a very serious matter at this time! Orderly! Request Captain Berger to come here."

In a few moments the artillery captain appeared. The general muttered:

"Mr. Cawthorne proposes to explain the method by which he floated that locomotive off the tracks. Be seated, gentlemen!"

"Four years ago," Cawthorne related, "a Mr. Farrow showed clearly that the law of gravitation is influenced by the Hertzian waves, and that they, in turn, could be influenced by electricity. I need not take up time to go into the technicalities of it all, but experimentation, right to the limit, has resulted in an apparatus—a condensing generator—which if so handled as to throw an electric zone around anything that has weight, will eliminate that weight, or more properly, will nullify the gravitation. That locomotive was lowered from our gyroplane nearly 8,000 feet above it!"

The captain gasped: "Do you mean, Mr. Cawthorne, that it was done without any communication with the earth—that there was no receiving antennae?"

Cawthorne grinned, slipped his hand in his pocket and drew out a few metal balls, as small as buckshot. He handed a couple to the general and the others to the captain.

"Those are the antennae. Simply solid metal balls! I don't care to tell the composition, just now; but they're perfectly harmless. A bushel of them was carried in the gyroplane and a few handfuls thrown down around the locomotive. Then, when the condensing generator was put into action the current found those antennae and the gravitation-suppression instantly occurred."

"Good heavens!" ejaculated the general. "It's beyond the realms of possibility, Mr Cawthorne!"

"Edison says that the limits of the possibilities of science are not yet in sight. What we have done seems impossible because it has never been demonstrated. But, your officer has seen, and has reported to you about the possibility."

"And the influence—or whatever it is—extends only to the radius covered by those balls?" broke in the captain.

"Much further than that, captain. On exhaustive experiments at my country home, conducted very secretly, we found that the influence—that's a good term—extends for fully half a mile on each side of any cluster of balls; although the intensity of the action is at its fullest among those balls. The suppression of gravitation becomes less as the distance increases."

"And yet the altitude of your gyroplane makes no difference?" demanded the general.

"We have worked up to 6,000 feet without finding any difference in the conditions or results."

The captain settled back in his chair and gazed at Cawthorne in blank astonishment, his arms hanging limply on each side of him. The general twisted one end of his gray mustache into his mouth and chewed it meditatively. Presently he growled:

"Why have you not put the war authorities in touch with this, instead of daring to come right onto the field and make a demonstration without even consulting me?"

Cawthorne leaned forward, his brows furrowed deeply and his lips pressed tightly together:

"Two years ago, general, the war authorities were shown this apparatus and they shrugged their shoulders and turned it down. If we had gone to them now with the perfected machine they'd have red-taped it until those Japo-Chinese devils had reached Washington, and then they'd have appointed an investigation committee, with an unlimited period of time for the investigation and tests. War authorities are not field officers, general!"

"That will do, sir! I can listen to no criticisms on the Government." But a twinkle in the stern old eyes softened the harshness of his tones.

"Your gyroplane is here, I suppose you know?"

Cawthorne grinned: "Yes! As soon as I heard where I was to be brought I signaled Kilroth, my assistant, to sail in here and descend. I suppose he's under arrest, too?"

The general smiled grimly but ignored the question.

"How did you expect to follow this up, Mr. Cawthorne?"

"First, by doing just what has happened—getting an interview with you. Next, by sailing over the river and—with your permission—floating all of that Chinese-Japo-Mexican aggregation into the air. How's that?"

The general glanced at the captain, his lips twitching. The next moment both burst into a roar of laughter. As it subsided, the general's hand shot out and grasped Ned's. "We can use you, sir! We'll have to, to save ourselves. I could spare 20 or 30 pounds very willingly, but the rest of my weight I want.

"But, under the regulations of war you'll have to come under my command. I'll appoint you a captain of aviation. Will that do?"

Cawthorne exclaimed bitterly: "It has been my greatest ambition to hold a commission in this war, general; but I have a cork leg—lost the other at polo. Does that disqualify me?"

"Perhaps," smiled the general. "But the aviation service is hardly down to fine restrictions, yet. We'll overlook the cork. What men do you carry in that aeroplane?"

"Two. Kilroth, one of the brainiest mechanics I ever knew, and Littleby, the —er—chauffeur, but there's room for two others."

The general nodded exultantly. "Captain Berger, you are detailed to accompany Mr.—er—Captain Cawthorne. Your rank, as an artillery officer, is above his, but you will act together. Now, I am going to call a council of war which you will both attend. We will then decide on your future movements."

"And in the meantime," laughed Cawthorne, "where am I to report? I am under arrest, you know."

Another laugh broke from the general. "You are on parole now, captain. Orderly! Report at the guard house that Mr. Kilroth and the pilot of that gyroplane are to be immediately released!"

As the orderly left, Cawthorne saluted and said:

"There are on the track at Denver three sealed freight cars consigned to me. They contain three more gyroplanes and a number of gravitation nullifiers. I didn't dare bring them any further for fear of —er—arrest; but they are now under your orders, general!"

"Good heavens! Three more of those machines all ready! Have them forwarded at once, captain! No! I'd better make the order—special run, too! We need all the reinforcements we can summon just now!"

* * *

Four thousand feet in the air the two captains, Cawthorne and Berger, were cruising over the trenches of the mixed brown and yellow men. Around them were a score of United States aeroplanes guarding the *U. S. N. 1* against attacks by Japo-Chinese airships.

The world just below was sparkling with angry flashes of flame preceding the rattle of machine guns and the explosion of shrapnel. The enemy had brought up no heavy guns, but from the American lines across the river came the terrific crash of field siege cannon. As far as Cawthorne could see on both sides of the Rio Grande were gusts of smoke; sometimes spasmodic; sometimes continuous clouds, for the entire line was in action.

Berger was watching the *selenium-phyche* plate on which, projected by the *X-ray* tube at headquarters, eight miles away, came their orders. Kilroth and Cawthorne were sitting handfuls of the globular antennae—Kilroth called them "attractors"—down into the line of trenches beneath. Suddenly Berger exclaimed to the pilot:

"Turn back, Everoth! Follow the same line! Now, Captain Cawthorne, put the generator-condenser into action!"

Cawthorne threw the switch and all gazed down. One aeroplane immediately below them was evidently deprived at once of its weight for its pilot lost control and it darted in a complete vertical revolution and then rushed far into the south.

"Must have caught a few of our attractors," grinned Kilroth. "Look below!"

Beneath them was as much confusion as if a tremendous explosion had occurred. Thousands of men were wriggling in the air, mixed up with machine guns, mortars and small arms. Everoth had slowed his motors down to 20 miles an

hour and in 15 minutes the generator condenser had passed over the five-mile line of trenches and utterly demoralized the enemy.

Firing ceased instantly and as the smoke swept away the fighters in the G.N.1 had a clear view as they turned and again sailed over the line. For a half mile ahead and behind them and to each side the enemy and its equipment were in the air, and as a stiff breeze was blowing into the north, thousands of those brown and yellow men and thousands of small arms and big guns were drifting like feathers towards the river.

As the gyroplane passed along and its zone of influence left those aerial enemies, their weight came back as suddenly as it had been nullified, and they dropped onto the plain or into the river. Firing from the American side had ceased and Berger yelled:

"Look Cawthorne! Our men are rushing down the pontoons. They'll have a bridge across in an hour! All we've got to do is to keep these fellows floating and dropping until our troops get across!"

They glided down within 200 feet of the surface. The enemy's aeroplanes had darted away, for as they came within the influence of the nullifier their control became alarmingly erratic. The American airships, previously warned, were prepared and followed the enemy in fierce attack.

Suddenly there was a shrill yell from the pilot, a dark shadow and a crash. One of the enemy's biplanes, recklessly driven or out of control, had rushed into the path of the G.N.1. There was no weight in either of the fliers, but the initial strength of structure was there, and the speed, and in a moment—the nullifier being crumpled out of action—both planes were tumbling to the ground. All but Everoth, who came down on rocks and broke both legs, landed in one of the trenches on top of a party of quivering Japs who had crawled back there after the first attack of the mysterious influence. But for the fact that in their aerial flutterings their rifles and even their revolvers had been wafted away from them, Cawthorne and his party would have met instant death. But they scrambled out and drawing their own revolvers, clustered about the wrecked gyroplane.

Captain Berger glanced around him. On every side sprawled men, clutching rocks, sagebrush, each other or parts of field guns; anything which, in their abject terror, might keep the weird, mysterious unknown from fluttering them again off their feet. Many of them were dead from plunges from great heights when their weight was restored. Many others were crippled in limbs or ribs. Others were crushed under machine guns or howitzers which had dropped on them.

Down at the extreme right of the line—a position which had been held by Cabellero's Mexicans—Berger saw a huge body of them rushing in frantic disorder back across the great plain to timber far in the rear. At another point nearer to him was a Jap officer gesticulating to his men in an effort to reorganize them, but not a man but himself was standing up.

"Here's a rescue, Berger!" shouted Cawthorne, as a big aeroplane glided to the ground close by, and he saw the khaki uniforms.

Instantly a lieutenant sprang out and ran over to them.

"We've room for your party, Captain Cawthorne. You can do nothing more here, I suppose," with a glance at the smashed gyroplane.

Cawthorne looked at Berger, who nodded, and then said:

"One of our men is injured. Is it possible to carry him out of this?"

"Here's another aero coming," replied the lieutenant. "Hi! What's this mean!"

A hundred rods to one side a number of armed Japs were rushing towards them. Cawthorne's party drew close together, revolvers in hand.

"Hold your fire 'til they're within a hundred feet!" commanded Berger, but the next moment Kilroth gave a fearful shriek, sprang four feet in the air, his arms waving wildly, and as he came down, he clutched at the wheel of a gun and clung to it, still howling.

The effect on the Japs was instantaneous and astoundingly effective. Everyone of them was groveling on his belly, clutching at brush, at rocks, at the hair or arms of his fellows, at anything for an anchorage to his dear old Mother Earth.

Kilroth doubled up in a paroxism of laughter, the contagion of which spread to the others.

"Pick up that wounded man!" shouted a voice, and they lifted him into the frame of the second aeroplane. Another instant they were all again in the air, sailing at full speed towards headquarters, while the Japanese officer was leaping among his prostrate men, striking them with the flat of his sword and using language which was perhaps appealing eloquence, but was certainly decorated with an unlimited assortment of profane trimmings.

"Marvelous! marvelous!" muttered General Illington as he heard their report. "Two hundred thousand of the enemy routed, and not one of your men lost!"

"One man injured!" grinned Cawthorne, "and we brought him out."

"The loss of the gyroplane is serious," muttered the general. "The enemy may rally before we get our bridge across; it will take fully an hour, yet; even if the engineers are not attacked by shell."

Captain saluted: "I think, general, that there isn't a gun over there in condition to go into action without repairs or adjustments."

"Have the other gyroplanes left Denver yet?" asked Cawthorne.

The general growled: "A report came in just before you arrived that the train had reached Valencia. But it adds that the line is terribly congested and that the train cannot reach here for 40 or 50 hours—perhaps longer!"

"Valencia!" muttered Cawthorne. "That's 400 miles. An aeroplane could make it in five hours, or less; we could assemble a machine in two hours and bring it here in another five. Twelve or 15 hours at the most, general!"

"Do it!" exclaimed the general. "I'll order those cars sidetracked at—er—Captain Berger, find out what station that train will reach five hours hence, and dispatch orders to drop those three cars there!" Then turning to Cawthorne: "The enemy has heavy reinforcements coming up, within a hundred and fifty miles of the river; and you'd be back in time to meet them. Take all the men you need and return with the first machine you can get together!"

Then he turned with a chuckling grin to Kilroth.

"You, my nullifier impersonator, can, I suppose, assemble the other machines and bring them to the front without delay!"

Kilroth grinned and bowed. Ten minutes later the party, with four skilled mechanics, were sailing north.

* * *

Coming northeast from Guaymas Bay, in the Gulf of California, was the main army of the Japo-Chinee-Mexican alliance. Almost in sight of each other train sections were crawling along the railroad, bringing up heavy field guns, aeroplanes, munitions, supplies and men. On the trails and plains mounted Mexicans of Cabellero's and Valejo's commands were advancing, devastating every ranch, village and town on the 10-mile wide trail.

The head of this army had reached Guadeloupe, 40 miles from the Rio Grande, and had encamped there waiting for more forces to come up; but when the amazing news arrived of the mysterious disaster at the front, they were again put on the march. Presently fugitives from the river straggled in, amazing and terrifying the new men with stories of their flotations.

A great group of aeroplanes appeared, three or four thousand feet above, for excepting a few held back for scouting purposes, every airship in Illington's division was escorting the G.N.2. Hovering about them at respectful distances were a few of the Japo-Chinee airships, and occasional flashes from guns showed spasmodic attempts at interference.

Presently there dropped on the advancing troops small pellets of metal which, coming from so great a height, caused severe wounds on the few men they happened to hit. Then one gyroplane—the G. N.2—darted below the others and glided directly over the column of troops beneath.

Again were the astounding conditions and demoralization at the Rio Grande repeated; but as there was not the slightest breeze the effects were not quite so evident to Cawthorne's party. Men lifting their feet to the march step were unable to replace them with any accuracy and would stagger or drift against each other in utter helplessness. Horses hauling heavy guns and baggage wagons suddenly plunged ahead as all weight behind vanished and then reared and sought in vain for secure footing. In an instant, as the gyroplane glided slowly over them, all order, all discipline and all courage disappeared. Men fluttered along the ground—sometimes head down, sometimes half a dozen clutch-

(Continued on page 303.)

YOU have read, of course, Mr. Stratton's interesting story "Omegon," last month. Here's the continuation: This story is as startling as it is original; moreover it is exceedingly timely and it may sound far more impossible than it really is, for Professor Thomas Jefferson Jackson See, of the Naval Observatory at Mare Island, Cal., has just announced one of the most important and momentous discoveries of the age. He claims that gravity is but another electrical phenomenon caused by electrical currents circulating about atoms of matter. If this is really so—and we have no reason to doubt the new theory—then Mr. Stratton's story is not only probable, but highly possible.

You must read this tale by all means.

Conserving Uncle George

By Thomas Reed

YOU know that gentleman by the name of Sloyd? He was the apostle of Care and Pains. If you are making a joint, he says just peer at as though all the joiners of Joinville were watching you with their eyes bulging out. And don't you dare to fudge it up.

The article you are making is not so important. You simply think up something to make that will have to have a joint on it. Say you decide on a wee knife-tray for mother. Mother would rather have a new set of knives and could keep them any old place; but father missed it on Amalgamated Shoestring Common and can't see the knives just now. Sorry. All the same mother pats you on the shoulder and says what a dear, thoughtful boy you are, and the hired girl turns the tray over and uses it to set the garbage pail on. And so it goes.

Sloyd may be all right; for certain natures—there's room for lots of things in the world—but the Experimental Bug thinks life is too short for his philosophy. If I confess something don't you tell Gernsback or he'd fire me out of the E. E. with a splash, mother's overboard; but I'll rather see an odd contraption rigged up out of a tomato can and three umbrella wires than the most perfect skewangular joint in the world.

Sloyd begins at the back end. You and I start by wanting something and wanting it bad, and then we go to work and make it with what tools and materials we've got. When it's done it may look like a chance grab from the dump, but what of that if it works?

Then if our crude rinktum succeeds, we begin all over again and rebuild it in worthy form—doll it up with a mahogany base and plenty of binding-posts. Even a few superfluous switches and milled nuts are not amiss just to give it tone. Oh I'm wise, I've been there. We want pa and the neighbors to exclaim respectfully, "Gee, ain't it great? what's it for?" instead of smiling scornfully as they recognize the gate hinge, the dry-battery carbon and the shaving-stick box.

In the chronic state of a boy's exchequer it's a tough choice between tools and materials, because every dollar spent for one means one dollar less for the other. Well, what'll we do about it? Conserve your resources, I say.

"..... We Want Pa and the Neighbors to Exclaim Respectfully, 'Gee, Ain't It Great? What's It For?'"

"What's that?" say you, "conserve 'em? They're so small it's as much as I can do to find 'em, let alone that con—con—that phoney word you used." "Well, listen," says I, "part of your resources is Uncle George, isn't it? Don't he generally come across about Christmas time or the birthday? Sure he does. Then he's a resource and you want to conserve him."

Now it's this way: Don't tap Uncle George for materials, but let him buy the tools. The little roll of that silk-covered wire that you want so much wouldn't appeal to him. It disappears and he thinks you're extravagant, and extravagance is bad for you. What he wants to give you is something huge and shiny—something you can pick up any time and say with tears of gratitude in your eyes, "Uncle George gave me that."

Well, humor him—that's the way we old fellows get to be so awful rich. Pretty soon Uncle George will begin testing out the ground in the guise of advance agent of S. Claus & Co., Ltd. Now don't let him, in his ignorance, blow you to one of these so-called tool-chests at which a pound of cheese would laugh. What do you want of a young tack-hammer, a chalkline, plumb-bob and a square that isn't square? No, sir, hand it to him straight about the drill and the center-punch and the hack-saw. Head him off from one of those things you can imitate a suspension bridge or a flying-machine with. If he commences to talk in two figures like a sport, you can suggest that he who passes along a good lathe would surely avoid the appearance of a piker.

Here's a list of tools you want—tools to use, not to form a museum with. Paste it in Uncle George's hat or on his eyebrow, and you will never regret it, though he may. I don't include the necessary hammer, saw, plane, etc., as I assume you have pinched father's!

Hand drill, $1.25; hacksaw, 50c.; hand beading tool, $1; center punch, 10c.; metal shears, 50c.; pliers, 25c.; iron rabbit-plane, $1; marking gauge, 25c.; iron vise, 3-in. jaw, $1.50; miter-box, $4.50; ratchet bit-stock, $1; countersink, 10c.; hand emery-wheel, $1.29; compass saw, 25c.; oilstone, 25c.; lathe, $40; bench vise screw (make your own jaws), 50c.; files, flat and half round, 25c. each; twist drills, ⅛ to ¼ by 64ths, about $1; wood bits, ¾, ⅝ and ½ in., 25c. each; expansion bit, ½ to 1½ in. 75c.; 8/32 tap and die, with die stock, $1.50; tool handle with enclosed awl points, etc., 25 to 75c.

Hits any mark from a tightwad to a joy-rider, eh, Bugs?

PROF. SEE CLAIMS TO KNOW CAUSE OF GRAVITATION.

Dr. Howard D. Minchin, of the University of Rochester, will inquire into the announcement of Prof. Thomas Jefferson Jackson See, one of the best-known astronomers and mathematicians in the United States and at present in charge of the Naval Observatory at Mare Island, Cal., that he has discovered the cause of gravitation. Students in science are greatly interested in the announcement coming from a man of such standing. Dr. Minchin said he could not intelligently comment on the discovery until he had investigated.

Professor See contends that gravitation is an electrical phenomenon which is caused by elementary electrical currents circulating about atoms of matter. The theory of Professor See is an extension and elaboration of physical laws first demonstrated by the French physicist, Ampere, 96 years ago. Ampere, whose name has been taken to denote the unit of electrical current, showed that two parallel currents of electricity flowing in the same direction attract each other, but repel when flowing in opposite directions.

The more atomic electric currents around one body of matter flowing in the same direction as the atomic currents in an adjacent body the more the two bodies will be attracted, Professor See contends, and this mutual attraction is nothing more nor less than gravity.

Gravitation, Professor See contends, does not act instantly across space, but is transmitted with the velocity of light. Thus it would come from the sun to the earth in eight minutes.

Professor See's treatise on his discovery is in the possession of the Royal Society of London. It was to this society that Sir Isaac Newton announced his laws of gravitation in 1685. The society has not yet passed upon the theory.

U. S. NAVAL RADIO SCHEMES PROGRESS.

The naval radio construction program of the Government has gone far enough to warrant the statement that it is to be carried forward to completion without exceeding the $1,500,000 limit of cost fixed by Congress. The system when in operation, it will be recalled, is to circle the globe, giving the American Government at Washington, D. C., direct control of its battleships, no matter in what part of the world they may be located.

The fund has been used in the construction and equipment of the naval radio station on the Canal Zone, which is now in operation; and is being used for the stations at San Diego and Honolulu, where work has begun; at Cavite, where arrangements for construction are under way, and at Guam, where the project is in the initial stage.

Can Electricity Transfer Thought Waves?

WHETHER electricity can or cannot transfer thought waves from one human brain to another is a much mooted question which has for some time occupied the minds of many of the foremost scientists in the old and new worlds. Among some of the more well-known and brilliant men who have seriously considered this matter there may be mentioned Thomas A. Edison, Sir Oliver Lodge and Prof. Alexander Graham Bell.

This whole subject revolves in a way about the science of psychic phenomena, it may be said, and this branch of little understood science considers as an absolute fact that "thoughts can be transferred from one mind to another," and in many cases workers in this branch of *science* (shall we call it science?) even claim to communicate with the departed spirits of deceased persons.

While most of us, in view of the present great intellectual activities and enlightenment of the day, are prone to scoff at all such theories and alleged demonstrations of a new art, it seemingly behooves us to think over the matter more than once, when such great scientific investigators as Bell, Edison and Lodge will condescend to look into such things seriously.

At a recent meeting of the American Institute of Electrical Engineers at New York City, where Dr. Bell, inventor of the telephone, was presented with the Edison medal "For Meritorious Achievement in Electrical Science," he, in response to the presentation address accompanying the gift of the medal, spoke as follows:

"What will come next? We now have electric light, electric power, electric speech and a swarm of electric appliances that have come into use during recent years. All of our knowledge of the external universe is derived from our senses, and science has brought electricity to the service of practically all of our senses. Are you going on? The possibilities of further development are inconceivable."

"Men can do nearly everything else by electricity already, and I can imagine them with coils of wire about their heads coming together for communication of thought by induction."

The audience of 1,000 electrical engineers and their guests showed no sign of being incredulous, even of this suggested possibility of electrical development. However, Dr. Bell added:

"But that is for you to make possible," with emphasis on the "you," and when the laughter had subsided he continued: "I have been struck by the fact that nearly all of the recent steps have had to do with vibrations. Suppose you have the power to make an iron rod vibrate with any desired frequency in a dark room. At first, when vibrating slowly, its movement will be indicated by only one sense, that of *touch*. Soon, as the vibrations increase, a low sound will emanate from it, and it will appeal to *two* senses. At about 32,000 vibrations to the second the sound will be loud and shrill, but at 40,000 vibrations it will be silent, and its movement will not be indicated by touch. Its movement will be indicated by no ordinary human sense. At 100,000, up to about 1,500,000 vibrations per second, we have no sense that can appreciate any effect. After that stage its movement is indicated first by the sense of *temperature*, and then, when the rod becomes red hot, by the sense of *sight*. At 3,000,000 it sheds violet light."

"Now the thought has occurred to me that there must be a great deal to be learned about the effect of those vibrations in the great gap where the ordinary human senses are unable to *hear, see or feel the movement*. The power to send wireless messages by etheric vibrations lies in that gap, but the gap is so great that it seems there must be more. You must make machines practically to supply new senses, as the wireless instruments do. Can it be said, when you think of that great gap, that there is no field in the further development of electrical science for you?"

The illustration herewith gives an idea of how the inductance coils proposed by Dr. Bell would appear on the head for the transmission and reception of thought waves from the human brains.

Sir Oliver Lodge, in dealing with the development of news intelligence transmission has declared that it is not unreasonable to say we will eventually become so developed that one man may call another by name, seeking to find him among the millions of the world's population, and if that man answered not then he must be no more in the flesh. This, indeed, seems to be one of the wonderful objectives toward which modern scientific investigation is directed.

Dr. Alexander Graham Bell has already experimented on the transmission of thought over long distances by means of electrical induction. The inventor of the telephone and his assistant, Prof. Ellis, capped their heads with improvised induction coils, but the only result of the brief first experiment—revealed by chance two years later—was that, while there was no transmission of thought, the sensation of nausea that afflicted Ellis at the time was communicated to Dr. Bell, a fact that he readily recalled when, in discussing the test after the lapse of time, the professor said he did not consider it a fair trial because he had a sick headache and a feeling of nausea. Dr. Bell thinks that it may be that various sensations can thus be more readily communicated than thought, and he expects at some future time to begin a more thorough experimentation.

Thomas A. Edison, the wizard of all inventors and probably the foremost American scientist, has been much impressed by some of this so-called *mental telepathic or thought wave* transmission, and particularly by one expert by the name of Mr. Bert Reese. Mr. Edison made a number of different rigid tests in connection with Mr. Reese, and also he made several experiments between the expert and employes at the Edison plant. Mr. Edison says of this matter: "Then I asked him to let me try. In this case I went into another building and wrote down the words 'Is there anything better than nickel hydroxide for an alkaline storage battery?'

"At that time I was experimenting with my new storage battery and felt somewhat dubious about being on the right track. In the meantime as I folded the slip of paper containing the above words in writing I filled my mind with a different problem and kept working on its solution so that Reese could not by 'mind-reading' decipher what I had written on the slip of paper, and re-

Will the Day Come When Even Our "Thoughts" Can Be Transmitted From One Brain to Another, Electrically?

turned to the room where I had left Reese. At the moment I entered the room he said: 'No there is nothing better than nickel hydroxide for an alkaline storage battery.'

"He had therefore read my question accurately, and to this day I am satisfied that there is nothing better than nickel hydroxide for that particular purpose.

"About two years afterward the boy from the gate-house of my laboratory came in and announced that Reese was in the gate-house and wanted to see me. I took out my pencil and wrote in microscopic letters the word 'Keau.' I folded the paper, put it in my pocket and then told the boy to bring Reese in. I greeted him and at once said: 'Reese, I have a slip of paper

(Continued on page 354.)

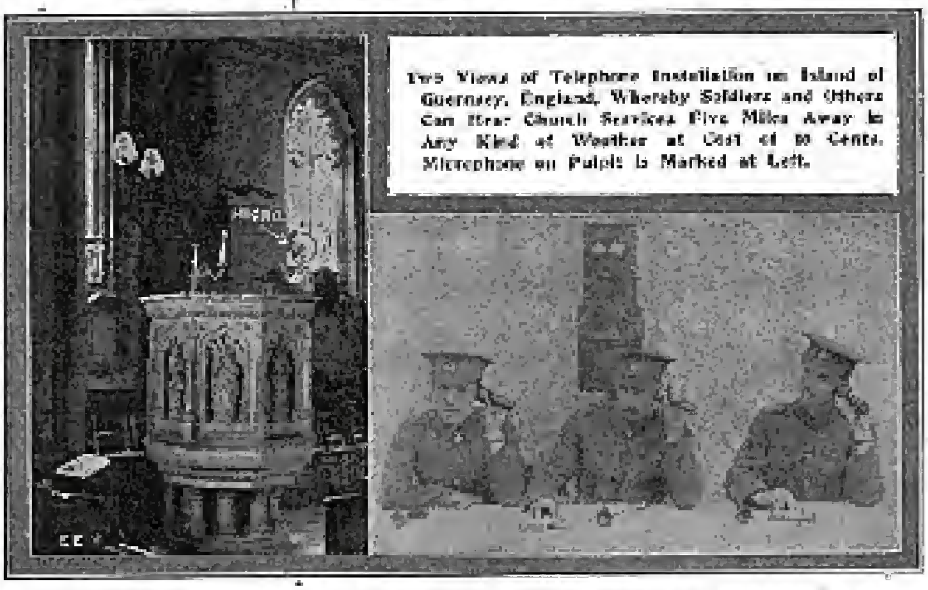
CHURCH SERVICE BY TELEPHONE.

By E. O. Catford.

In Guernsey, England, if a Sunday happens to be disturbed by the elements, the populace can remain at home by their comfortable hearth and listen to the sermon, the organ and choir instead of tramping through the rain or snow, as the case may be, and then arriving at the church in so irritable and distressed a condition that they can hardly and whole-heartedly participate in the church service.

This is accomplished by having the telephone exchange connect you to the church by a switch. The charge for this service is 10 cents, but public officials, such as police, firemen, militia and others, who are kept from church services by their duties, are given the privilege free of charge.

At Platte Fougere Light-house Station (Guernsey), where these photos were taken, frequently as many as eight persons sit around the table on a Sunday evening, listening to the minister's sermon five miles away.



Two Views of Telephone Installation on Island of Guernsey, England, Whereby Soldiers and Others Can Hear Church Services Five Miles Away in Any Kind of Weather at Cost of 10 Cents. Microphone on Pulpit is Marked at Left.

TESLA SUES MARCONI FOR WIRELESS CONTROL.

Nikola Tesla has appealed to the law to declare that he and not William Marconi is the inventor of wireless telegraphy. Many millions in money and world-wide control of the commercial use of the wireless transmission of energy are involved in the struggle.

The suit has been brought in the United States District Court in the name of the Nikola Tesla Co., of which the Serbian inventor is the president and to which he has transferred all of his fundamental patent rights in wireless telegraphy. The defendant in the action is the Marconi Wireless Telegraph Co. of America.

Mr. Tesla announced recently in connection with the suit that he has just been granted a patent by the United States Government which will supersede and revolutionize all present forms and applications of wireless telegraphy and will enable him and the financiers who are associated with him to obtain and keep a hold on commercial wireless telegraphy, no matter what may be the outcome of the litigation he has begun against the Marconi interests.

"My earlier experiments in Colorado in 1899," he said, "demonstrated that I was on the right track, and with a transmitter of my invention of not more than 30 inches in diameter I succeeded in concentrating and applying an amount of electrical energy twice as strong as is contained in an ordinary stroke of lightning.

"Since then I have pursued my experiments with that one point in view, namely, the discovery of a way of concentrating and absolutely controlling electrical energy. This result has been attained under the workings of the apparatus for which the Government granted me a patent last December.

"I now claim that I can confine any amount of electrical energy, and that, too, without the use of insulation. The Marconi and other existing systems of wireless telegraphy require that there shall be insulation in connection with the transmitter. I can now send a wireless current entirely across the ocean.

"In transmitting a Marconi wireless current, for example, not more than 20 or 30 horsepower of energy is required; with my new apparatus I can concentrate and direct 5,000 horsepower of electrical energy.

"With this tremendous energy thus concentrated and controlled I can telephone by wireless across the ocean. I can use the apparatus, also, for sending a blaze of light over great distances."

Mr. Tesla in the complaint alleges that he is the inventor of a system of transmission of electrical energy and of apparatus arranged for that method and system, for which he received a patent, numbered 645,576, applied for on Sept. 2, 1897, and issued March 20, 1900, and for which he also received a patent, numbered 649,621, applied for at the same time as the other, and issued by the commissioner on May 15, 1900.

Marconi's application for a patent on wireless telegraphy, the complaint asserts, was filed on Nov. 10, 1900, and was not granted and issued until June 28, 1904, being numbered 763,772.

The Tesla company asks the court to declare the Marconi wireless telegraph patent null and void, claiming that the Marconi patent covers the inventions and combinations of apparatus described and claimed in the Tesla patents.

The Marconi company has put in an answer denying any infringement.

The Tesla company also has begun a suit against the Marconi company for alleged infringement of the Tesla patents.

[Ed. Note.—Tesla's patents and wireless transmission of energy are covered in "Wireless Telegraphy" by Sewall, procurable from our Book Department at $2.15 prepaid.]

CAN ELECTRICITY TRANSFER THOUGHT WAVES?

(Continued from page 253.)

in my pocket, what is on it?" Without a moment's hesitation he said "zero.'"

Mr. H. Gernsback, who has studied considerably such matters as mental telepathy and also such matters as "thought transmission" in so far as the matter can be studied at this time, has made a suggestion which may be mentioned as worthy of trial in this field. This suggestion embodies the use of a set of one or more sensitive Thermo-couples, which, as we know, produce an electric current whenever they are heated. It has been found that invariably whenever the brain is concentrated on some problem, or thought, that heat is produced in such a way that it will cause the forehead of a person to perspire, even though slightly. Now if this Thermo-couple arrangement is placed against the forehead there is a possibility that waves might be picked up and transmitted over a wire to a proper receiving apparatus or instrument attached to the head of a second person.

A theory promulgated by Mr. H. W. Secor takes for its basis a somewhat different phenomena. This particular action is nothing more nor less than the *Aurora*, which we know exists for quite an appreciable distance about the human body. Some time ago a well-known English scientist and investigator made it possible to view these vari-colored *aurorae* surrounding the human body by utilizing specially devised screens, and when looking through these screens the ever-changing aurora about the body could be very clearly observed. Moreover, and in line with Mr. Secor's theory, these aurorae are of different colors or hues for different conditions of the mind or brain in the person under observation. They are red, or reddish yellow, when the person is in great anger, and thus they change through various colors for different emotions. If the inductance coils of Dr. Bell, and proposed by him to be strapped around the head, will work at all, it seems very likely that they would act by means of these aurorae discharge from the body and which quite possibly is electrical in its nature. If this is so then a simple coil at both transmitter and receiver end of the line should suffice, as the variation in the electrical *aurorae* set-up about the body and controlled by the brain would then induce corresponding ever-changing currents in the first coil to be transmitted over the line to the second coil. This coil could then, in virtue of the fluctuating currents passing through it from the line, influence the *auroral field* about the body of the second person on whose head the coil was placed.

It has been pointed out by several electrical men, and particularly by Dr. Giuseppe Musso, the well-known consulting electrical engineer of New York City, that quite possibly the points at which to apply these transmitting and receiving coils, or other forms of apparatus, is not about the head at all, but at some other vulnerable point or points on the body which would have to be found by experiment, and also in consideration of the fact that these more vulnerable points have the strongest effect on the control of the electric charge on the body. He also has said that in thought transference it has been invariably noted that best results are obtained between two persons having a strong affection for each other, which in another sense might be considered as two minds "in tune" or syntony.

Are you a regular reader? It will pay you to become one!

Electric Toys That Respond To The Voice

ANOTHER novelty for amusing children has arrived in the form of toys, voice operated by electricity. These new toys afford entertainment for

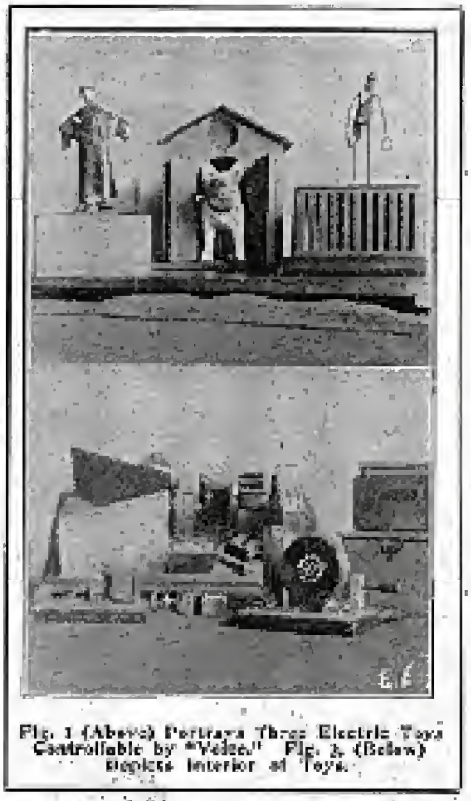


Fig. 1 (Above) Portrays Three Electric Toys Controllable by "Voice." Fig. 2, (Below) Displays Interior of Toys.

pleasure-loving youngsters as well as the adult, and are operated by sound waves actuating a delicate microphone, by which the various movements of the toy are incited.

The toys herewith illustrated are the results of continuous labor by Mr. H. Christian Berger, the inventor and originator of the submarine wireless system, which was described at length in the August issue of this magazine. These toys in order to operate require solely the human voice or a common whistle. Nor is it necessary to be near the toys; they will operate, for instance, if the whistle is blown 30 feet distant from the apparatus with a result

Fig. 3. At Left Shows Voice Controlled Gun. At Right a Disappearing Satan's Head.

that is as amazing as it is startling in its novelty.

Fig. 1 represents a group of three electric toys. The one at the left is a *policeman*, enclosed in a case; who, when a certain sound is produced, suddenly jumps up from the case. In the center is a small dog, resting in his miniature kennel, the doors of which are closed. As soon as an ordinary whistle is blown the doors open and the little animal jumps out so suddenly that one is almost taken aback at the unexpectedness of his appearance. The third and most interesting is the *dancing coon* seen at the right. This coon will perform all kinds of dances as long as the proper tune or sound is produced.

The grate opening in the front of the cabinet is the collector of the sounds which are caused to act on the microphone.

Fig. 2 depicts a schematic diagram of the apparatus used within the dancing doll's abode. M is a microphone connected in series with a battery and relay D, operating a pair of electro-magnets H, which are connected in series with a vibrator L. In operation, when the sound waves strike the microphone M, the resistance of same varies, and the current strength in the magnet D decreases. The armature closes the contacts, X Y, energizing the magnet H, and short-circuiting the microphone. The excitation of the magnet D then again increases and attracts its armature, consequently varying the the fluctuations in electro-magnet H, which in turn operates the doll at Fig. 2, whose hands and feet are made of coiled steel springs. This metal is attracted by magnetism, generated by the electro-magnet H. Also the shoes may be of iron so as to be acted upon by the electro-magnet.

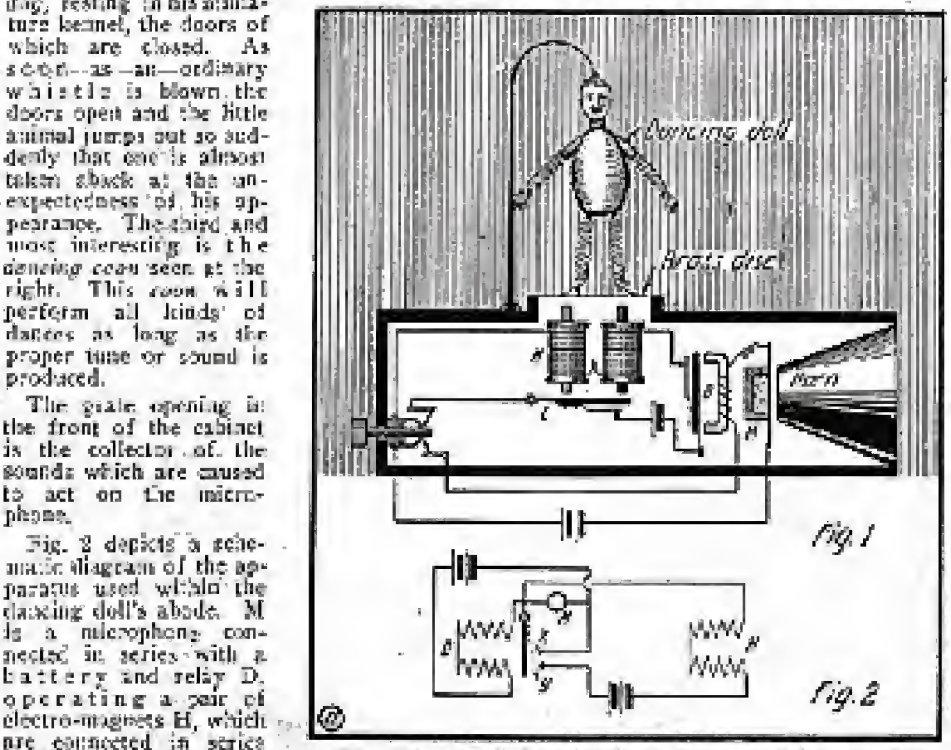


Fig. 2. Diagram of "Dancing Doll" Apparatus Subject to Voice Control.

Fig. 4. A Whistle Will Fire This Miniature Field Cannon.

The interior view of these toys is shown at Fig. 5. The apparatus on the right is a microphone relay, operating any electrical device just by the production of sound, acting upon the microphone.

The larger instrument, seen in the background of the photograph, is the exact apparatus used in the electric *dancing coon*; while the one towards the left is an automatic controlling relay. The whistle here shown is used as the sound actuator of these novel toys.

Miniature "field guns" are also operated by sound waves, and Fig. 4 illustrates such a gun, which is electrically fired and operated by sounds produced from the whistle shown at the extreme right, near the wagon containing the ordinary instruments used for operating the other toys.

Two very interesting toys are portrayed in Fig. 3; the one at the left, representing a device for throwing a "ball" into the air, while the other is a "Satan's Head" concealed in the chimney of the small house, as perceived, who immediately appears at the sound of a voice.

A very suitable toy for Christmas time is illustrated at Fig. 6. This is a tree decorated with miniature electric bulbs, connected to a circuit, including a microphone and batteries, as seen at the left. The lamps on the tree are operated by the microphone whenever sounds are produced by the blowing of the whistle seen in the foreground.

These extremely interesting electric toys

Fig. 6. Electric Lights on Xmas Tree Controllable by Whistle and Microphonic Relay.

mark a distinct advance in the realm of amusement apparatus, and it seems this principle could be well applied further.

A LIGHTHOUSE OPERATED AND CHECKED BY ELECTRICITY.

By Edwin O. Catford.

WHEREVER men are placed in an isolated situation with long continued responsibilities the need for some kind of check or inspection becomes evident. Personal inspection in such cases is necessarily infrequent and therefore inefficient. The men concerned, if they are competent and keen on their work, will welcome any device which is an aid to efficiency.

Some devices of the writer's in use at Platte Fougère Lighthouse Station, Guernsey, England, may be of interest, since they constitute the equivalent to an hourly inspection day and night, year in and year out, with the advantage of automatic and therefore absolutely impartial working.

A clock is provided with a roll of paper attached on which the man on duty records his signature each hour. This clock is also used to note the time of starting and stopping the "fog signal," and in the event of any dispute arising in regard to these times the clock record proves invaluable.

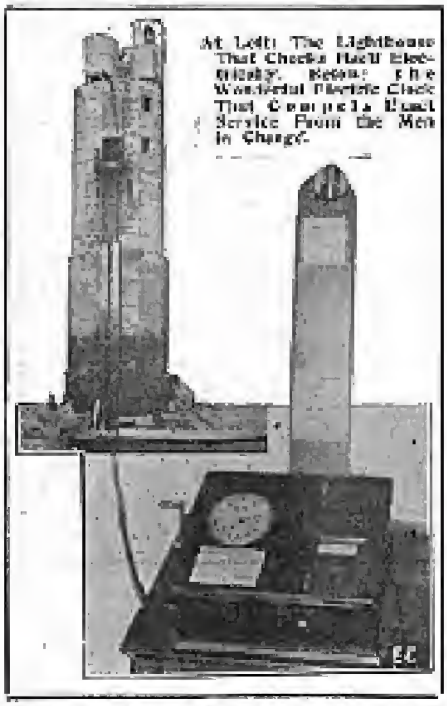
Several electric attachments have been added by the author to this clock.

First, some contacts insure that if the man on duty has not "signed on" the clock will set three electric alarm bells ringing at 20 minutes past the hour.

These bells are situated, respectively, in the engine room and in each of two dwelling houses, so that they serve to call out the keeper who is off duty. Thus this clock may truly be said to be equal to the provision of an hourly inspection day and night.

Should the man on duty meet with an accident during the night, which is always possible with dangerous machinery as used for fog signaling, without these clock attachments he would simply lie until morning with the added probability, almost amounting to certainty, that the machinery also would come to a standstill with the fog still remaining.

The clock insures that should an accident occur which disables the man on duty so that he cannot sign at the clock, at 20 minutes after the next hour the alarm will automatically be raised and the second man called out to duty. Thus by calling aid the clock might save a man's life.



At Left: The Lighthouse That Checks Itself Electrically. Below: The Wonderful Electric Clock That Compels Exact Service From the Men in Charge.

The clock is also a complete safeguard against sleepfulness at night, for which felony it provides instant punishment.

The writer can testify that it is a most disagreeable experience to hear the bells ring out at night and to realize that the whole of your own household, as well as that of your neighbor, has been aroused from sleep by one's own delinquency.

In order to give an indication that the electric alarm attachment is in constant order, it is so arranged that each bell gives a single stroke every hour.

This notifies that all is in order and incidentally shows in both houses that the clock connections have not been tampered with. Twenty minutes later the alarm bells ring out in earnest, unless in the interval the man on duty has "signed on" at the clock.

The recording clock with the author's electric attachment compels the lifting of the clock handle once every hour.

Seizing on this fact it was next arranged that by means of further electric contacts attached to the handle a testing current passes out to the lighthouse through one wire of the cable, returning by another wire, each time the clock is operated; that is, once every hour day and night.

This provides a test for continuity of the cable, it also indicates that the electric lamps and electric lighting circuit are intact and, further, by means of a special pressure gauge on the lighthouse it gives warning whenever less than a fortnight's supply of acetylene remains for the light.

Double pole contacts are used so that no battery leakage can take place through the cable when the test is not being made. Those who know the insidious electrolytic troubles liable to introduce themselves wherever any continuous leakage of current, however small, becomes possible will appreciate this point.

These indications are useful at all times, but they are doubly appreciated on days and nights when the sea dashes with terrible fury on land and lighthouse, and it is evident that many days must elapse before a visit to the lighthouse will become possible.

To be able then, simply by lifting a handle (in safety) ashore, to obtain assurance as to the condition of affairs on the storm-swept lighthouse is no small gain.

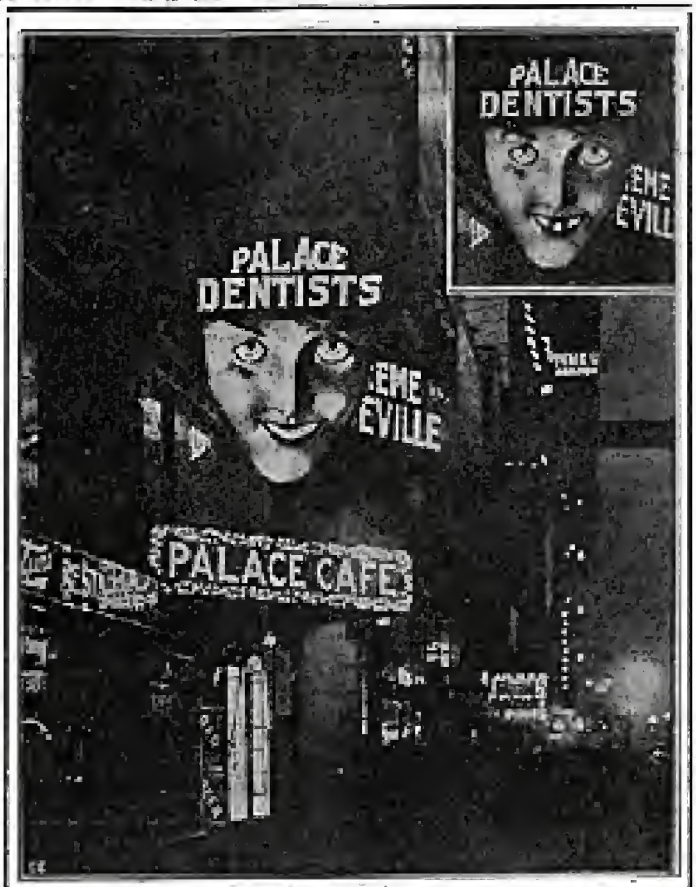
ELECTRIC DENTAL SIGN THAT DEMONSTRATES "BEFORE" AND "AFTER" EFFECTS.

A very pretentious electric sign erected in New York City for a large dental parlor, as shown in illustration and the small insert picture, shows the countenance as it is supposed to appear before visiting the dentist, and the larger photo the satisfied smile and improved appearance of the teeth after taking treatment.

This sign is a large affair and is made entirely of opal glass, which is lighted up from the interior of the sign by means of electric bulbs properly arranged. These are operated by a motor driven flasher, so that the two different faces appear alternately. The features of the countenance where the two teeth are shown missing is also caused to change, so that the general appearance is one of sadness or pain.

This novel electric sign is one of the well-known *Federal* line, and attracts unusual interest in the endless crowds that throng the "Gay White Way" of the Old Town.

Such electric signs as here described are a great improvement upon those of a few years ago, to be sure.



Top View Shows "Before" Appearance of Face, and Lower Illustration, "After" Effect, Produced in New Electric Sign.

LIMIT TUCKERTON WIRELESS.

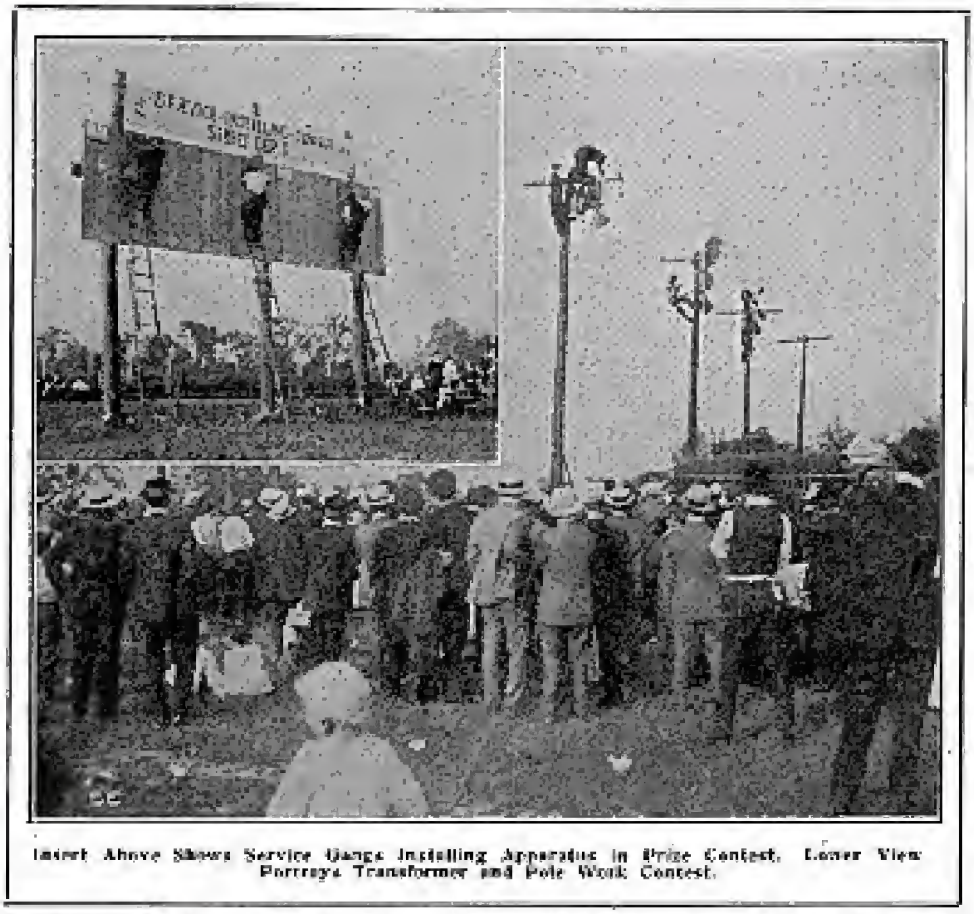
None but Government and Embassy messages will be sent by way of the Tuckerton wireless station until further notice. Messages for Germany and Austria must be forwarded by way of Sayville at the same as ea.

AUTHORS! ATTENTION!

What ideas have you regarding the construction and operation of wireless and electrical apparatus? Why not write up these ideas and experiments for the benefit of the *Electrical Experimenter* readers and thus help yourself and your fellow-worker at the same time. We are pleased to receive contributions of the above character with plain ordinary sketches or photographs and pay regular rates for all such matter published in these columns. Address all communications to the Editor.

Installing A Complete Electric Service in 15 Minutes

As one of the features of the annual field day and outing of the Commonwealth Edison Company, of Chicago, service gangs from each of the company's three overhead districts competed in a service installation contest. The crew representing each district had previously been selected by elimination contests conducted in regular service-installation work during the two weeks preceding the field day.



Insert Above Shows Service Gangs Installing Apparatus in Prize Contest. Lower View Portrays Transformer and Pole Work Contest.

Before the day of the final competition a pole line carrying primary wires on single arms was erected on the field. A platform on which three sections of brick wall were mounted was also erected at a distance of 75 feet from the poles. Above it were placed three regular service outlets connected to groups of lamps. Each gang consisted of a foreman, two linemen and a groundman. The foremen were not allowed to do any work. Sitting in their trucks, which were loaded with standard tools and equipment, the men awaited the signal to start.

The rules of the contest required each crew to do the following work: Cut a gain and bore a hole for a buck arm on the pole; install the buck arm with brackets and primary cut-outs; hang a transformer; connect the transformer to the primary circuit and to the service drop; install a bracket with three Pierce bolts on the brick wall; run a 75-foot two-wire service from the pole to the bracket, and connect the service to the outlets. All joints were to be soldered and properly taped. The last thing to be done was to insert the primary plugs to light the lamps above the outlets, indicating that the work had been completed. Any failure to complete the job according to the company's standard practice was to result in a penalty equal to three times the time it would ordinarily take to do that part of the work. Any violation of the company's safety rules was to result in disqualifying the whole gang. Three judges with stop watches took the time and observed the work as it proceeded.

In addition to the prize money offered to the winner of this contest as one of the regular field days events, an added bonus of two cents for each second under 20 minutes was provided for each man in the winning crew.

None of the gangs were disqualified for violating the company's safety rules. The winning crew was, however, penalized 15 seconds for spilling solder.

YACHT'S "MONEL" METAL HULL RUINED BY ELECTROLYSIS.

Alexander Smith Cochran's magnificent schooner yacht "Sea Call," after being in commission only six weeks, is now being broken up for scrap in the yards of her builders at Neponset, Mass.

The "Sea Call" is a splendid sailing yacht with auxiliary gasoline engine. She is being knocked to pieces on account of the disintegration of her bottom through electrical action.

The electrolysis which has damaged the bottom of the boat is said to be due to the use of a steel skeleton and a bottom of coated metal, an expensive alloy composed of, roughly, two parts nickel to one part copper, with small additions of other metals.

It was understood that electrolysis affected the steel skeleton and not the plates of the bottom, but reports from Neponset say that, while the action did start around the stem and stern posts, which are of steel, it resulted in the deterioration of the monel into "a chalky substance." It is said that there are evidences of deterioration in the monel plates of the bottom, but the suggestion has been made that this is only disglobeation due to the electrolysis of the steel.

AN ELECTRIC BACTERIOLOGICAL INCUBATOR.

By Frank C. Perkins.

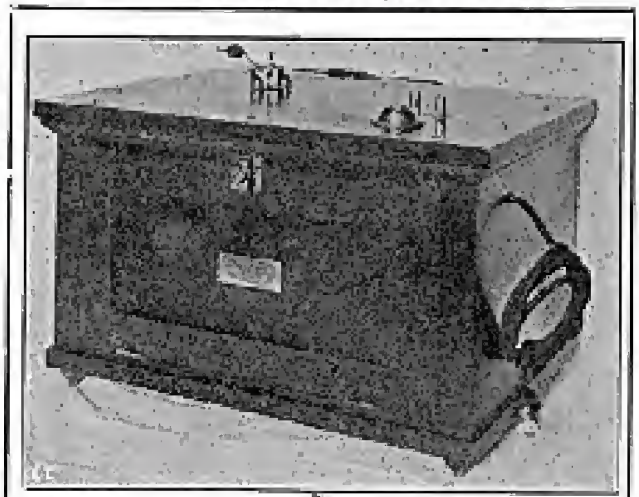
The accompanying illustration shows a most interesting electric bacteriological incubator said to be in advance of the gas-heated devices now generally used on account of the extremely uniform temperature regulation provided.

It was developed at Salt Lake City, Utah, and is so designed that when once adjusted to the desired temperature, it is claimed, it will operate for days at a time without any attention. The incubator is heated with electric resistance coils in the top of the device.

It may be stated that there is a wafer thermostat inside the machine which expands with rise in temperature and pushes a piston stem which raises and lowers a balanced lever arm carrying two electric contact points. These two contact points dip in mercury cups, which are connected in series with one side of the circuit. When the temperature inside the incubator reaches the desired point the contact point is lifted out of the mercury, thus opening the circuit. When the temperature falls just a small fraction of a degree the contact points are lowered back in the mercury and the circuit is closed, thus bringing the machine back to the proper temperature.

It is held that a variation of less than 0.1 degree will cause the device to operate and to open or close the circuit. Temperature adjustment is obtained by means of a small screw. The incubator consists of a double-walled box having a 0.5-inch air space between the outer and inner walls. The box is finished in mahogany and is equipped with double doors, the inner door having a glass panel so that the contents of the machine may be readily inspected without opening the door.

By means of the button seen on top of the machine a miniature lamp inside the incubator can be turned on. The maximum input into the machine is 50 watts, and the average input per hour is about 25 watts. It measures 8 inches in width and 10 inches in height, with a length of 16 inches.



An Automatically Compensated Electric Incubator With Electric Heating Coils.

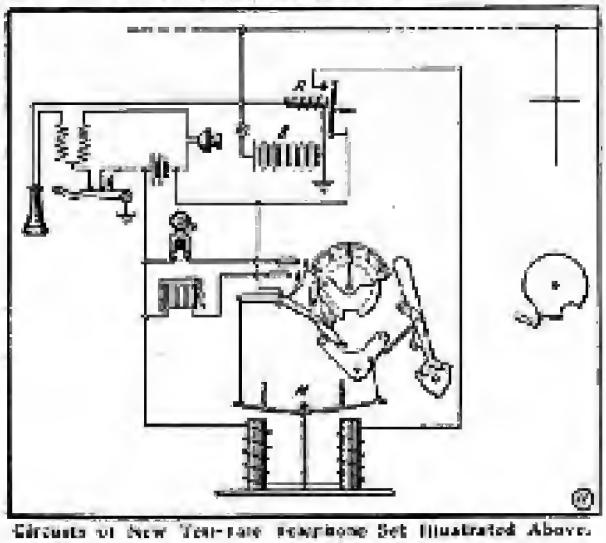
TELEPHONE THAT TELLS WHO CALLED WHILE YOU WERE OUT.

On a single-wire, party-line telephone circuit near Constableville, N. Y., each subscriber is provided with a telephone in-

Novel Telephone Set That Tells Who "Called" While You Were Out.

strument equipped not only with a selective ringing attachment, but also with a device to inform the subscriber who, if anyone, called in his absence. The instruments were constructed under specifications covered in a patent issued to P. G. Bernholtz, Constableville, N. Y. They differ from the standard grounded-return telephone in that a special battery has been added to the local circuit and a visual signal or drop, as well as a bell, has been arranged to operate through an especially designed selective-signaling mechanism.

To call a subscriber on a line equipped with these instruments it is necessary to close the special battery (*B*) circuit through the push-button. The special battery operating all relays (*R*) on the line unlocks all instruments. The indicator then moves automatically to the desired number, and when the line is again energized the selective-signaling apparatus in the called subscriber's instrument rings the bell and operates the visual signal or drop. Other instruments return to their normal positions. If it so happens that the called party is not within earshot of the bell, he notes on his return that the visual signal has been operated. He then places his indicator on *R* and energizes the line by means of the special battery, ringing all bells on the line, but failing to actuate any of the visual signals because the indicator was set at position *R*. Hearing this call and observing that the visual signal has not been disturbed, all subscribers understand the signal, and only the one who previously called and failed to obtain the individual with whom he desired to communicate is supposed to answer.



Circuits of New Telephone Set Illustrated Above.

A Telephonic "Nursemaid" and a Bird Alarm

The accompanying illustration shows the application of the telephone as a nursemaid as devised by an ingenious Englishman. Open air life is undoubtedly best for babies, who indeed, showing a wisdom beyond their years, sleep at once out of doors after strenuously refusing to sleep inside the house. The difficulty has been that where there is no housemaid the busy mother cannot spare time to be constantly outside looking after baby.

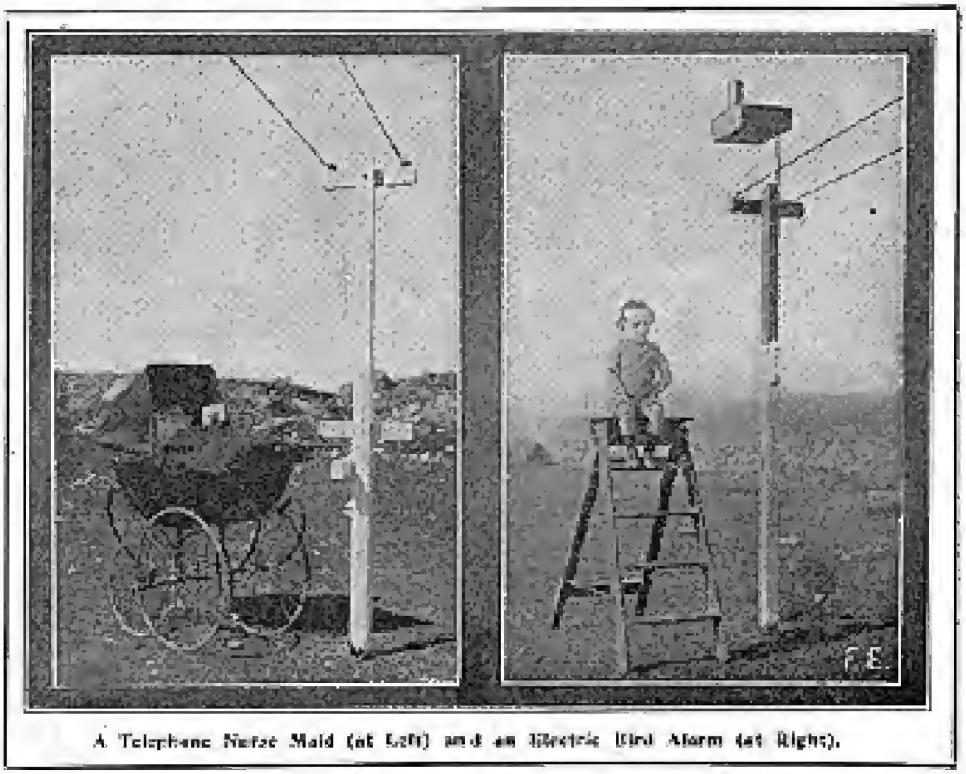
The photograph shows the details of a plan successfully employed by Edwin Catford, the engineer-in-charge at Plane Fougaré lighthouse, Guernsey, where the baby carriage is provided with a cigar box containing a telephone transmitter and a small clock. Wires running up to the house, 20 yards away, enable the mother in the intervals of work to listen for baby's cry; if at the table and during meals it is easy to listen continuously.

A clock attachment was also provided. "No news is good news" does very well as a popular saying, but the electrical engineer knows better, for *no noise* often means a hitch in the means of communication. In this case the clock is added so that the sound of its ticking may indicate that the telephone is transmitting sounds correctly. The device proved entirely successful through baby's first years. Not only was baby's cry distinctly heard, but also the comments of persons not knowing of the telephone in the cigar box who approach the spot on the common where baby sleeps. A rain alarm was also evolved to give warning by causing an electric bell to ring should a shower come on.

The second illustration shows an interesting birds' telephone, devised also by E. O. Catford for the benefit of his little son.

As cats kept birds at a distance from the house so that this little boy could not have the pleasure of watching them feed from crumbs thrown out, a cat-proof tray was therefore set up in front of the windows at some distance from the house and here robins, finches and other birds came to feed.

It is of interest to note that the telephone transmitter was then added, so that when the birds sang they could be listened to in the house. Doubtless a better plan would have been to conceal telephone transmitters among the branches of bird-frequented trees, but here there were no trees available. The transmitter in use is the ordinary kind used for speech and is protected from rain by an inverted cocoa tin, well painted, open at the lower end to freely admit sound. After months at this outdoor use the telephone remained in perfect condition.



A Telephone Nurse Maid (at Left) and an Electric Bird Alarm (at Right).

TELEPHONE NEW POLICE AID.

Police Commissioner Arthur Woods announced recently that the New York Telephone Co. will co-operate with the police department in capturing criminals. The territory within 100 miles of New York has been divided into seven zones, and as soon as headquarters notifies the telephone company descriptions of men wanted will be sent to all the zones.

Within a few minutes all chiefs of police, sheriffs, constables and railroad station men can be on the lookout.

WIRELESS AND PIGEONS.

Recent experience has tended to show that carrier pigeons and other birds of passage are guided by magnetic currents. W. A. Thauvin, a French student of pigeons, has noted that on two occasions when pigeon flights were unsatisfactory magnetic storms were occurring; and the flights of these birds have been becoming often uncertain and erratic since wireless telegraphy came into extensive use.

An Electro-Magnetic Nail-Packing Machine

By Frank G. Perkins

THE accompanying illustration, Fig. 1, shows an interesting electro-magnetic nail-packing machine developed at Zurich, Switzerland, while Fig. 2 shows the scheme of packing and indicates the saving accomplished with this orderly method of doing the work as devised by Otto Gamper. Note the new style packages at the right of Fig. 2, containing as many nails as the keg in the center.

One type of this electro-magnetic nail-packing machine is suitable for paralleling and packing nails 2 to 6 inches long, and a special construction for nails 2 to 16 inches long. Until recently, in spite of the fact that for a long time in the nail industry there has been felt the need of a really practical paralleling and packing machine, no one has succeeded in designing an apparatus capable of performing the time-wasting operations of paralleling and packing of nails in a thoroughly satisfactory manner.

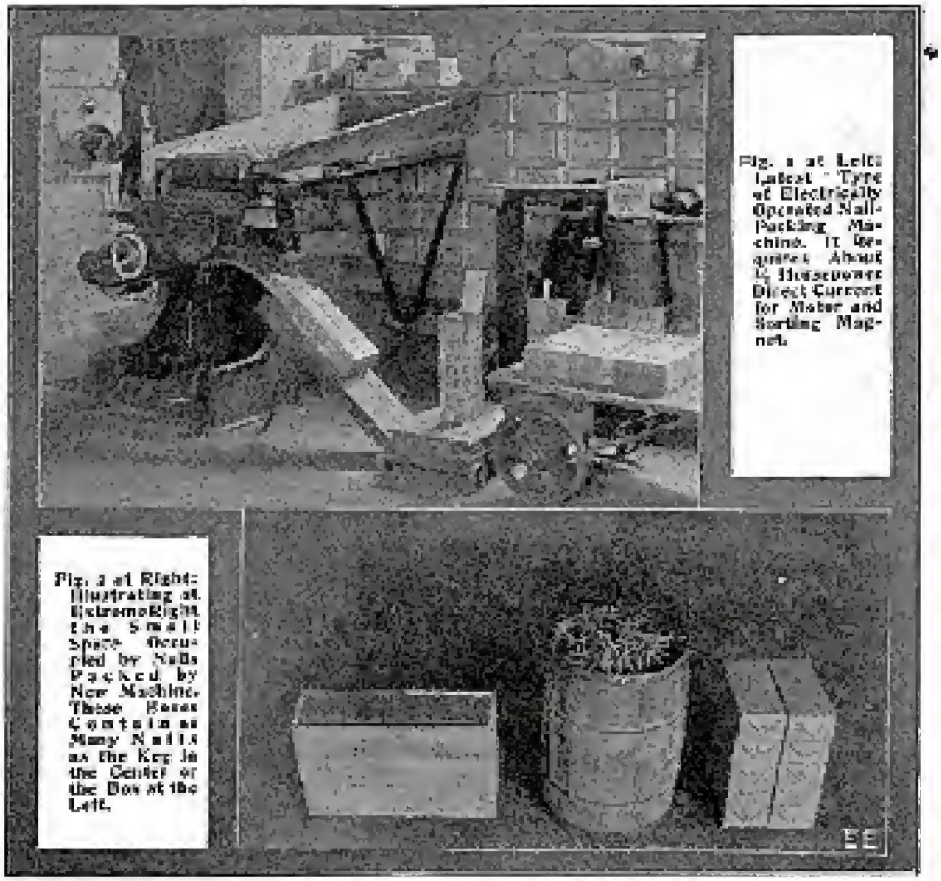


Fig. 1 at Left (Latest Type of Electrically Operated Nail-Packing Machine. It Requires About ½ Horsepower Direct Current for Motor and Sorting Magnet.

Fig. 2 at Right: Illustrating at Extreme Right the Small Space Occupied by Nails Packed by New Machine. These Boxes Contain as Many Nails as the Keg in the Center of the Box at the Left.

This packing machine is based on the principle well known to every electrician, that all linear iron objects, as soon as they are brought into a homogeneous magnetic field, must adjust themselves automatically, under the influence of the magnetizing current, in the direction of the magnetic lines of force, which, as is well known, always run parallel to each other. This being so, it, of course, follows that this machine is not only suited for the paralleling and filling of nails, but that it can be equally well used for packing all magnetically excitable linear objects, such as wire rods, coach screws, hairpins, pens and knife blades.

It will be noted that the machine consists of two main parts, a paralleling mechanism and a feed trough above it, into which a shaking device is fitted. The objects to be packed are emptied into the feed trough in quantities of about 10 cwt., whence through the action of the shaking device they glide gradually into the paralleling mechanism and then, while still falling, are drawn in the direction of the magnetic lines of force. As a consequence they are paralleled in a mathematically exact manner. The objects, thus arranged in parallel and held suspended in the paralleling mechanism by the lines of force, are by means of a lever, which simultaneously cuts out the magnetizing current, pressed into a tray which is fixed between the two magnet poles. This sheet iron tray swings downward, and from it the objects get emptied by a slight jerk into the paper packet, the mouth of which is placed over the end of the tray by the operative in order to receive them.

It is stated that this simple working cycle, making it possible for a girl to attend to the machine, can be repeated so rapidly that one workgirl trained to a certain extent for such work can in one hour deal with ordinary nails of No. 3-6-inch equal to 1,700 to 2,400 pounds in packets of 10 pounds each and No. 10-3½-inch equal to 1,200 to 1,400 pounds, in packets of 7 pounds each, while moulders' nails are handled at the rate of No. 15-6-inch equal to 600 to 800 pounds in packets of 10 pounds each and nearly the same number of packets of 1½-inch, 2-inch, 3-inch and 4-inch nails.

It is claimed that the above quantities represent the following values when compared with these dealt with by hand: Ordinary nails, 4 to 5 times the quantity dealt with by hand, and moulders' nails, 10 to 15 times the quantity dealt with by hand, involving, of course, a corresponding saving in wages.

(Continued on page 266.)

WIRELESS ON MOTORCYCLE TO PACIFIC COAST.

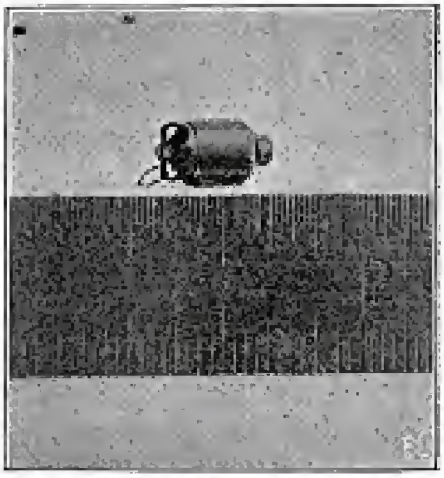
By A. J. Geiss.

Mr. and Mrs. Wengatz, of Albany, N. Y., passed through Toledo, O., on their way to the Pacific Coast on July 20 last. Mr. Wengatz will be joined later on by Fred Wallace, also of Albany. Their outfit consists of a Dayton motorcycle with side car and trailer. They carry a complete wireless telegraph outfit, and Mr. Wallace, who is a licensed radio operator, will communicate with wireless stations at distant points along their route. They expect to reach the coast in three months, and if the war ends this fall the trio expects to make it a tour of the world.

Wireless Set on Motorcycle Bound for Pacific Coast.

THE SMALLEST ELECTRIC MOTOR.

A motor recently completed by Ivan T. Nedland, a jeweler of North Dakota, weighs only 3.3 grains and is said to be the smallest motor in the world. Its commutator, which measures 0.045 inch in diameter, is made up of four gold segments insulated from each other with mica. No glue or cement was used in its construction. The shaft on which the commutator is mounted is made of steel and is 0.009 inch in diameter. Fiber insulation is used between the commutator and the shaft. The tiny armature, 0.09 inch in diameter, has four pole pieces and is wound with No. 40 silk-covered copper wire. The weight of the revolving part is 1.25 grains. Between the armature and the yoke two field coils are provided. The silver brushes measure 0.018 inch in diameter and are held against the commutator by springs 0.004 inch in diameter. In overall dimensions the motor measures 19/64 inch long and 11/64 inch high. All visible parts are finished in Roman gold. When connected to a small flashlight battery the motor runs at a very high speed.



Said to be the Smallest Electric Motor in the World. It Measures 19/64 Inch Long.

ELECTRICITY ON GERMAN SUBMARINES.

Electricity plays the leading role in the operation and navigation of the modern submarine, the terror of the undersea. The illustration herewith shows the compactly arranged electrical and gasoline engine unit installed in a modern German submarine, half of the hull of the boat being left off, so as to show a sectional view. Those interested would do well to peruse an exhaustive article entitled "Electricity, the Power Behind the Submarine Boat," which appeared in the *July*, 1915, issue of this journal, wherein all of the important functions of the electrical installation of modern submarines are fully discussed and illustrated.

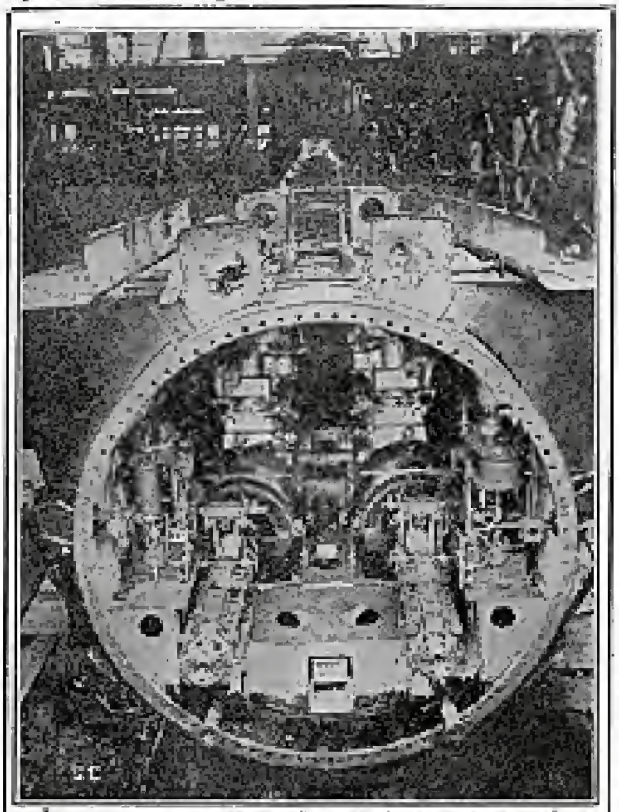


Photo (C) by Underwood & Underwood.

Remarkable Interior View of a German Submarine, Showing the Powerful Electric Motors.

The submarine of to-day is one of the most highly perfected mechanisms ever wrought by the hand of man, and enables the crew of same to sink beneath the surface of the sea and to cruise in this fashion, submerged entirely from sight, for a distance of 100 miles or more, without coming to the surface for air. Special air purifiers and regenerators are provided. Powerful electric storage batteries drive the motors connected to the propellers of the boat when under water. On the surface the gasoline engines are generally used for cruising and, simultaneously, these also drive the motors as dynamos, thus generating current for charging the storage batteries. These boats carry wireless installations of considerable range, as well as the very latest types of submarine signaling devices, operating on *etheric* as well as on the *sound wave* principle, whereby telegraphic signals can be transmitted from one submarine to another through the water and also from a submarine to its mother ship or tender.

The latest vessels of this class have a large cruising range of several thousand miles before returning to their base, and they can be submerged and raised from the subsurface very rapidly, owing to the ingenious and highly perfected electrical control arrangements provided and which are all quickly available by means of a concentrated group of push buttons at the commander's side, when he is scanning the sea through the periscope for possible victims.

ELECTRIC LIGHTING AT PANAMA CANAL.

Our illustration shows the beautiful electrical illumination of the Panama Canal at the Pedro Miguel Locks. The powerful electric lamps are placed on tall concrete columns. The electric current utilized for these lamps is generated at the Gatun Spillway. These ornate lamps serve a double purpose. They permit the passing of the vessels through the canal at night and also make it easier to guard the locks from an attack by an enemy in time of war.

Efficient Electric Lighting Will Help to Guard the Panama Canal.

EDISON'S SECRET.

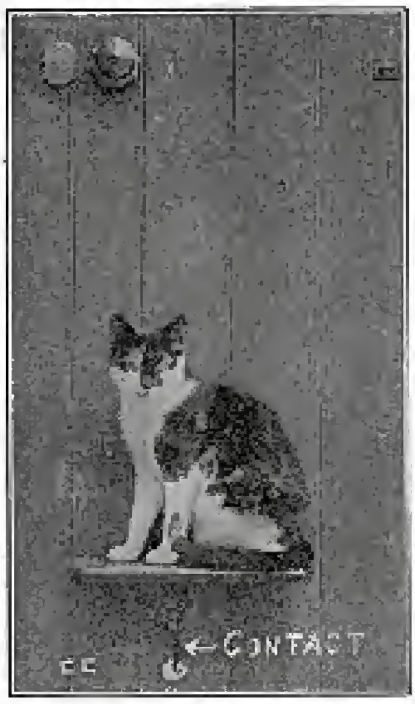
Thomas A. Edison says new methods of slaughter are in their infancy to-day, but that he cannot find it within himself to work along any line looking to the destruction of life.

He says the possibilities of chemistry and electricity have hardly yet been touched upon in modern warfare, that he knows of more deadly things than the gas bomb that he could invent, "but I can't get myself to work on any such stuff as that. I don't want to destroy life; I want to make the world a better place to live in."

It's a beautiful thought of the great inventor. But maybe in the secret he holds is the awful something that would compel world peace.

HOW "PUSSY" RINGS THE DOOR BELL.

An interesting photograph is shown herewith of an intellectual cat owned by Mr. E. L. Catford, of Guernsey (England). The feline announces his desire to enter the kitchen door by sitting on the small shelf observed in the photo. When the cat sits on the shelf an electrical contact spring is closed, which rings the electric bell on the interior of the house.



"Pussy" Gains Admittance by Dropping on this Electric Alarm Shelf.

With very little training this particular member of the cat family soon learned to hop on the shelf whenever it desired to come in, especially during storms, and now makes regular use of the shelf, no matter what kind of weather ensues.

AN ELECTRO-MAGNETIC NAIL-PACKING MACHINE.

(*Continued from page 259.*)

It is pointed out that taking the average reduction in volume to be 30 per cent. for nails arranged in parallel, as compared with such nails shaken loosely into boxes, kegs or barrels, the advantages in connection with packing in boxes and barrels include 20 to 45 per cent. saving of wood through using smaller boxes, kegs or barrels and 10 to 15 per cent. saving in delivery charges through reduced tare, also 40 to 50 per cent. saving in storage.

It is maintained that by using this machine for box filling one obtains 30 per cent. reduction of space with ordinary nails and 50 per cent. reduction of space with moulders' nails, also a 30-45 per cent. saving of wood by using smaller boxes and 10-15 per cent. saving in delivery charges owing to reduced tare.

The electric drive of the machine is of interest. It requires about ¾ hp., either from a high-speed line shaft, or where electric driving power is available from a motor erected on the machine. This latter drive is to be preferred because the packing machine is made independent of the line shaft.

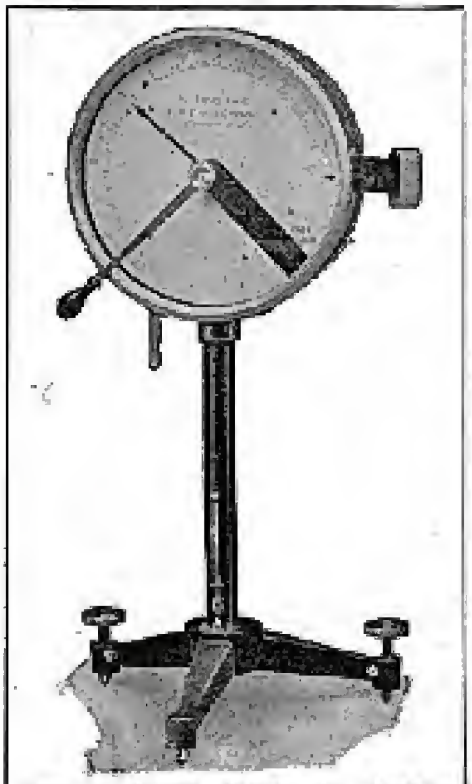
The electric current required is small. The feeding of the required coils, the current for which amounts to about 1.5 kw. hours per day, takes place by direct connection to an existing direct current supply line having a tension of 110 to 220 volts. Where no direct but alternating current energy is available the necessary direct current is generated by a small converter. If there is no electric energy available the same is generated by a direct current generator mounted on the packing machine. The machine is 5 feet high and takes up a space 6 feet 8 inches to 4 feet 4 inches and its weight is about 15 cwt.

OUR NOVEMBER ISSUE

will contain a wonderful article on "Selenium." You cannot possibly afford to miss it.

NEW SCALE FOR WEIGHING LAMP FILAMENTS.

A precision torsion balance of special design is shown in the illustration herewith. This device is used in general for



Precision Torsion Balance for Weighing Lamp Filaments.

weighing extremely light bodies, but its principal application is in connection with the incandescent lamp industry. In the manufacture of incandescent lamps it is essential that the filament possess certain characteristics, one of which is that its length and, therefore, its weight shall be uniform within certain predetermined limits. While high accuracy is, of course, requisite, the instrument must at the same time be rugged; and these two features are embodied in this instrument.

In use the balance is set on a vibrationless table and carefully leveled by means of the leveling screw and plumb-bob. The filament is then hung on the hook which is shown projecting from the right side of the case. The moving element is then freed by manipulating the lever which projects through the bottom of the case just to the left of the vertical support. The large pointer is moved slowly across the scale until the small pointer shown adjacent to the hook comes to the zero point. The indication of the large pointer is then that of the weight of the filament which is being tested.

In actual use the manually operated pointer is set at the presumed weight of the filament, and the position of the small pointer indicates whether the filament is above or below that weight or is exactly the same. These balances are in general use in practically all the lamp factories in this country.

HOW ELECTRICITY GROWS IN SOUTH.

In 10 years South Carolina's jump in consuming electricity by the kilowatt-hour was from 18,000,000 to 356,000,000. This is the largest proportionate gain of any State in the country. New York leads in output of electrical energy, more than 2,000,000,000 kilowatt-hours being used in 1915.

Marconi Heads Wireless Corps of Italian Army.

Signor Guglielmo Marconi, the famous Italian wireless inventor, is seen in our photograph herewith at the key of a large English wireless station located at London. The was taken on his recent trip to England, where he went on special business regarding some new wireless sets he has recently developed for the use of the soldiers in the field and which are said to be small enough and efficient enough to permit officers obtaining information while on the battlefield without utilizing the more cumbersome "trunk" sets making up the regular radio equipment of the signal corps division.

Signor Marconi is at the head of the wireless division of the Italian army and navy and, needless to say, their equipment will be second to none in the great European war.

This master genius has had wonderful opportunities to test out wireless telegraphy over vast distances and with all kinds of apparatus in a more practical way perhaps than has been possible for any other engineer or scientist of our day. It has not always been so, however, as many of our greatest inventors and scientists, notably Hertz, have unfortunately never seen their ideas commercialized to any such extent as has Signor Marconi. The Marconi corporations today operate over the greatest ranges and utilize the very latest apparatus known to the art. Marconi is to Italy what Edison is to the United States. He has rendered a service to mankind that will not be forgotten for centuries to come.

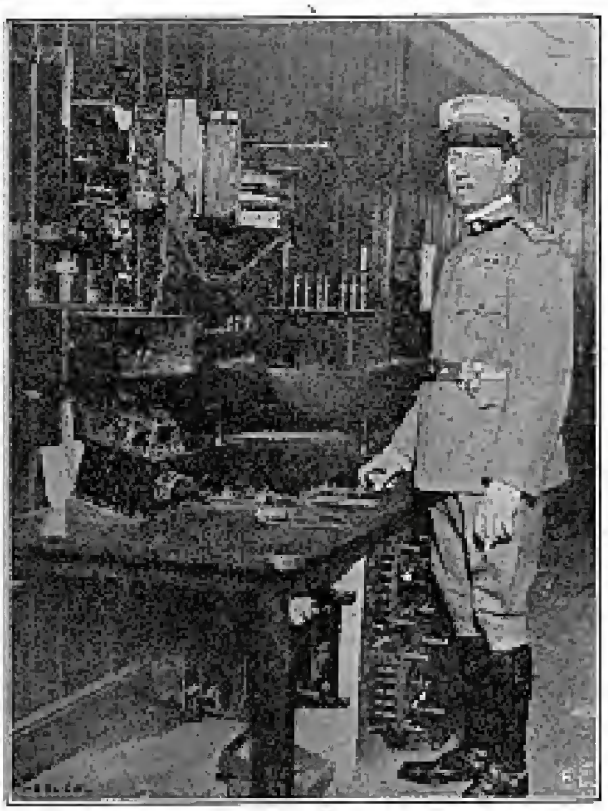


Photo (C) by Underwood & Underwood.
Signor Marconi at the Key of a British Radio Station. A Recent Picture.

COMPLIMENTS ARLINGTON WIRELESS.

Captain Gowan, master of the Johnston liner "Swanmore," at Baltimore, pays a high compliment to the perfect working of the Arlington wireless station. Captain Gowan states that when 1,400 miles off the American coast he is able to catch with great clearness the noon-time signal sent out from Arlington. So clear does the signal come that each tick of it can be heard distinctly. Beyond 1,400 miles the time from the Eiffel tower at Paris is picked up, but it is not clear and often leaves him in doubt about the real time sent out. This superiority of the American station, Captain Gowan said, was not always at times, but was always so satisfactory that he rated his chronometers by it without a doubt as to accuracy.

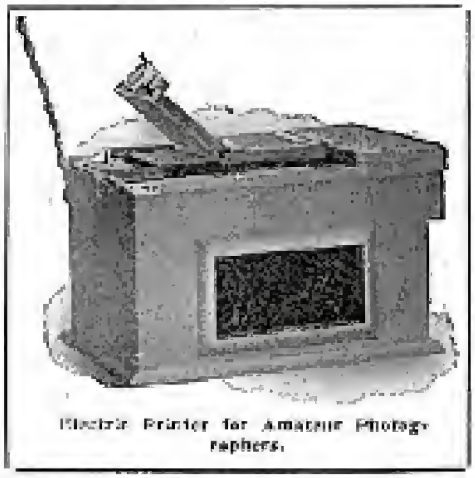
A NEW ELECTRIC PHOTO PRINTER.

The "you-do-the-rest" part is one of the most delightful phases of photography. It is a pleasure, of course, to take pictures, but you are not getting all the fun, all the delight till you *make* them.

For printing there now comes the Kodak amateur printer, a new thing—new of necessity embodying, as it does, the very latest ideas in photographic printing.

The printer consists of a box with a removable top in which is located the printing glass. Inside the box are two electric lights—one, a small, red bulb which supplies the necessary illumination for the adjustment of negative and paper, the other, a powerful Mazda lamp which provides the printing light. At the side of the box is a window covered with orange fabric which serves as a dark-room lamp with the red bulb turned on or, with the Mazda lamp, a safe light for Velox developing.

A particular feature is an automatic masking device. Thin metal strips which may be adjusted as desired mask the paper with perfect accuracy, so that prints with white margins may be obtained from any



Electric Printer for Amateur Photographers.

film negatives from the vest pocket up to and including the 4x5 and postcard size. A hinged frame holds the negative and paper tightly together.

The exposure is entirely automatic. When the hinged cover holding the negative and paper is closed the Mazda lamp is automatically turned on, when the catch is released the Mazda lamp is extinguished and the red bulb burns. This arrangement prevents wasted current in making prints.

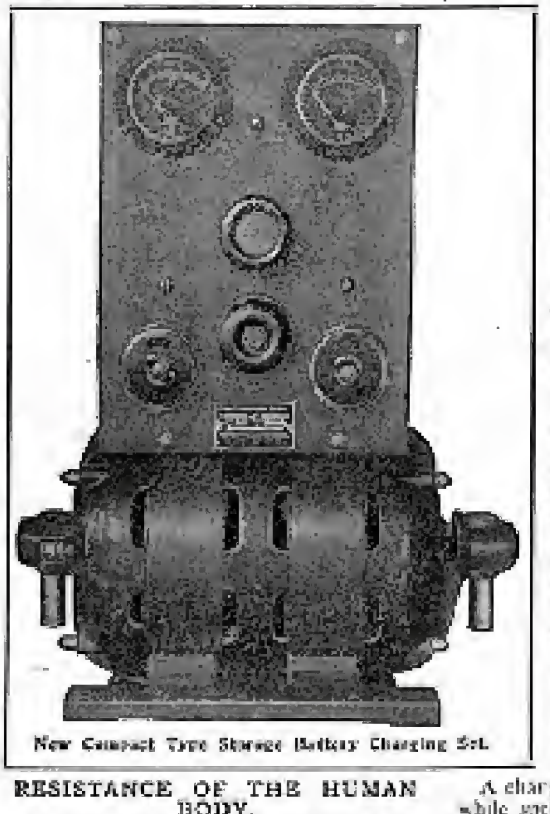
NEW COMPACT BATTERY CHARGING SET.

The new battery charging outfit shown herewith is designed especially for service in garages for charging automobile ignition and lighting batteries. This outfit consists of a small motor-generator set on which is mounted a small switchboard panel bearing all the switches, instruments, etc., necessary for their control. The outfit is to be connected to the incandescent lighting circuit by means of lamp cord and plug, the motor generator being supplied for service on 110 or 220 volt, 60 cycle, alternating current circuit, or on 110 or 220 volt, direct current circuit.

The motor generator is supplied to deliver direct current at 12, 18 or 24 volts, such voltage being specifically adapted for charging 12, 18 and 24 volt batteries.

The switchboard, which is mounted upon these sets, has a snap switch in the line circuit for the purpose of starting and stopping the set; a snap switch in the circuit from the generator to the batteries to be charged, for opening the charging circuit; a voltmeter for reading the voltage delivered by the generator; an ammeter for reading the charging current, and a field rheostat for raising or lowering the voltage of the generator end of the set and, therefore, serving to adjust the battery-charging current.

This set needs practically no attention in service other than an occasional filling of the bearing grease cups with oil. The switchboard, bearing all of the instruments, rheostats, switches, etc., properly wired, leaves as the whole work of installation simply the necessity of connecting to lighting circuit and to battery by lamp cord.



New Compact Type Storage Battery Charging Set.

RESISTANCE OF THE HUMAN BODY.

A human being is not generally looked upon in terms of ohms, yet if a man grasps two oppositely charged terminals, he becomes as much a part of the circuit as the wire itself, and he offers a certain resistance to the flow of current.

It has been estimated by capable authorities that the resistance of the human body is about 10,000 ohms, but it varies greatly with the path the current takes through the body. If a person firmly grasps two metal conductors the resistance from one hand to the other is only from 1,000 to 3,000 ohms. If a shorter path be taken, as for instance through a man's head, the resistance is very much less.

Some interesting experiments have been made relative to the conductivity of the human body, and it has been found, by means of very delicate instruments, that the resistance of the same body varies constantly, even different human moods affecting it.

A change of diet also makes a difference, while such a slight event as a third person entering a room causes a change in the result. One very variable element in the result is the resistance of the skin. When dry, the skin may be regarded almost as an insulator, but by having the pores full of liquid matter the resistance is much reduced.

Nervous people have been found to have a very low resistance, as have also heavy smokers and drinkers.

How The "Movies" Exploit Wireless

We reproduce herewith illustration from one of the popular "movies" of the day, known as the *Romance of Elaine*, in which wireless telegraphy plays an important rôle. The picture in question shows Prof. Arnold, as he is known in the film episode, which is entitled "The Wireless Detective," at the special wireless set on board his yacht. He is seen picking up secret radio signals being sent out from the hidden station of the conspirators, who play an important part in this exciting story.

An Exciting Moment in "Romance of Elaine" Film When the "Wireless" Helps to Locate the Conspirators.

The wireless outfit used are quite ordinary, generally speaking, but in our photo may be seen (at the left) lying on the table an instrument somewhat resembling a Galvanometer. This device is one of Prof. Arnold's marvelous inventions and when connected to any wireless set is supposed to show how far away and exactly in what direction a wireless station lies and from which the signals are being received.

Truly, this is a little ahead of applied science in this direction, as while we have the Radio-Goniometer, which will show quite accurately the direction in which a wireless station lies, we have not as yet any instrument which will show how far away a station is when signals are received from same at any other radio station. Possibly, however, such a device will be used by future radio engineers, and thus it is that the "movies" show the way unwittingly in scientific advance, so it seems.

INVENTOR CLAIMS TO GET CURRENT FROM AIR.

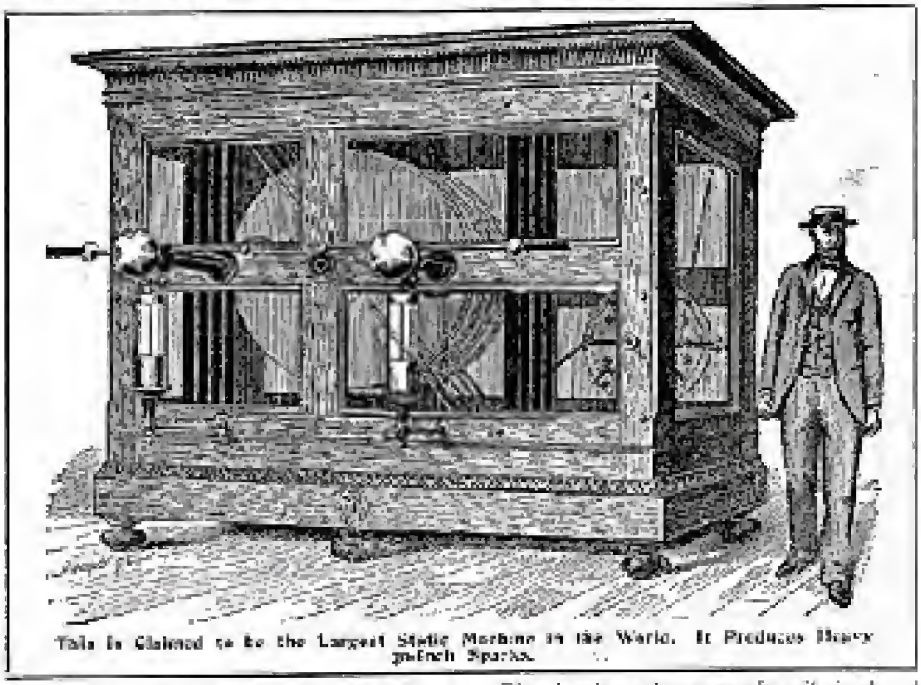
Following the same principles as those involved in wireless telegraphy, A. Bloomfield, an oil district inventor of Pemeta, Okla., claims to have discovered a method of drawing current from the air and successfully propelling a motor without other power. So successful has he been in his demonstrations that the Federal Government has taken it up and has asked the inventor to take his model to the Brooklyn Navy Yard for a test.

The model which Bloomfield has made is a small motor of about one-quarter horsepower. By means of a mast, erected to a height of 75 feet, the current is drawn from the air and the motor is operated.

[Ed.—*Such schemes do not seem to be practical, and we have our doubts about this one.*]

LARGEST STATIC MACHINE IN THE WORLD.

What is claimed to be the largest Holtz type static induction machine in the world is that shown in the illustration herewith. It was built by a well-known New York concern. The relative size of this mastodon of static machines may be judged by the comparative size of the man, shown in the picture. It is in use in the Battle Creek Sanitarium, Battle Creek, Mich., and previous to its installation at that institution it was set up and demonstrated in the laboratory at the College of the City of New York, where its merits and electro-therapeutical properties were explained by Dr. Roger Dooners to countless hundreds of the medical and electro-therapeutical profession.



This is Claimed to be the Largest Static Machine in the World. It Produces Heavy 9-inch Sparks.

This monster static generator stands 8 feet high and carries eight stationary plates and eight revolving discs. These discs are 60 inches in diameter and they are excited primarily by a small 30-inch plate diameter Toppler-Holtz static machine, which may be observed in one corner of the massive plate glass cabinet, containing the larger machine elements. This machine is capable of producing heavy spark discharges 50 inches long and a wonderful brush discharge of considerably greater length.

LIST OF NEW RADIO STATIONS ANNOUNCED.

The Bureau of Navigation of the United States Department of Commerce announces a list of six additions made to the land stations of the country in the radio service and 16 additional ship stations since the last bulletin on the subject was issued. Of the land stations, the one of longest range is at Tokoyara, Alaska, which has a normal reach of 300 nautical miles. The station is located in longitude 149:26 west and latitude 65 north; the wave lengths are 300 and 600 meters, the latter normal, and the system is Telefunken, with 1,000 sparks per second. It is operated by the Alaska Wireless Telegraph Co.

Other land stations established are: Rialto, Cal., 200 miles range; Massie system, 200 per second; wave length, 600 normal, 300 and 1,600; longitude 117:26:53 west, latitude 34:12:08 north; operated by Southern California Edison Co. limited to correspondence with stations of that company. Two at Portland, Ore., each with range of 150 miles; are operated by Charles L. Austin; latitude 45:30:45, longitude 122:42:30 west; limited to correspondence on ships' business with vessels entering and leaving the port of Portland; composite system, 450 per second; wave lengths, 600 normal, 300 and 350; the second operated by the Northwestern Electric Co., composite system, 400 per second; longitude 122:41 west, latitude 45:32; wave lengths, 600 normal, 300 and 1,700. Fort Adams, R. I., 125 miles range, United States Army system, 500 per second; wave length 1,500; operated and controlled by United States Signal Corps, War Department, and used exclusively for Government business. Marconi station, at Juneau, Alaska, statistics not available.

Of the new ship stations, the largest are the Ossipee and Tallapoosa, each operated and controlled by the United States Coast Guard, Treasury Department, with range of 300 miles, and the Roosevelt, operated and controlled by the Bureau of Fisheries of the Department of Commerce, with a similar range. The Ossipee and Tallapoosa are available for the general public, with rates of 4 cents per word, 40 cents minimum per radiogram.

The Bureau of Navigation has now in the hands of the printer an edition of the "List of Radio Stations of the United States," which will be issued within a short time. Inquiries should be sent to Superintendent of Documents, Washington, D. C.

Watch for wonderful article on "Warfare in the Future" in next issue.

AN EXTREMELY USEFUL HAND MAGNET.

The hand magnet here described is designed for operation on 110 or 220-volt direct current circuits, and is furnished with a 6-foot length of reinforced flexible cord and a standard attachment plug.

The circuit to the magnetic coils is closed and opened by means of a quick make-and-break snap switch mounted in the handle support. A brass push-button, insulated from the switch, is conveniently located for operation by the thumb when grasping the handle. Pushing the button closes the circuit to the coils and makes the magnet operative. Slight release of the button does not cause the circuit to be opened until the button reaches almost the normal position, when the switch mechanism operates with a quick break and opens the circuit. The magnet then becomes de-energized.

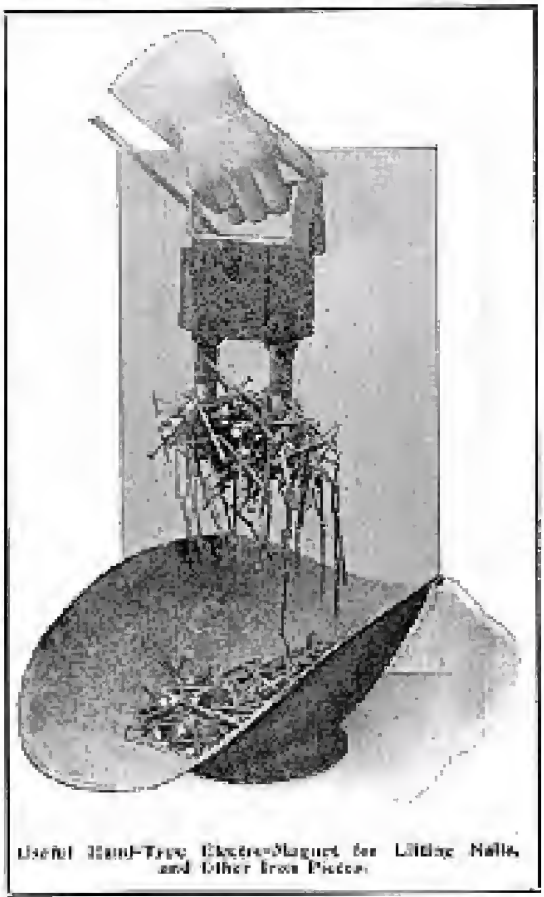
The hand magnet is used in machine shops for clearing chips and borings out of the machinery or removing them from parts of the work not easily accessible. Dropped tools, bolts, boring bars, etc., are easily recovered with the aid of the magnet from places from which it would be difficult to fish them by ordinary means. The weight of the hand-magnet is only 7½ pounds.

In shops where large quantities of brass and iron filings accumulate the hand-magnet is useful since brass being non-magnetic is not attracted by the magnet, like iron, thus enabling the two metals to be separated by merely passing the magnet through the mixed metals.

In foundries this magnet may be used to pick up flat or awkwardly shaped castings; smooth plates, which are sometimes difficult to secure a hold on when lying on a flat surface, or for cleaning the molding sand of minute particles of metal.

Suspended with its two poles immersed in the liquid, the magnet will attract to itself any particles of iron or steel which it may be desired to remove from the tubs in which paints, glazes, cements, etc., are mixed. It is also used for dipping can covers, etc.

In the shipping department many hundreds of nails are recovered daily by hand from the sweepings. For work of this sort, or for handling nails, nuts, screws, etc., in hardware stores the hand-magnet is particularly useful.



Useful Hand-Type Electro-Magnet for Lifting Nails, and Other Iron Pieces.

Electric Spark Pictures

THE illustrations herewith present some new ideas on electric spark pictures.

While electric spark pictures, of course, have been taken right along, our illustrations present some modifications, and in order to show our readers how these pictures are made, a short treatise on the subject will not be amiss. An ordinary spark picture is taken as follows:

Any spark coil from one quarter-inch up to three inches with a fast vibrator should be used. Connect one lead of the secondary terminal to a piece of tin foil or to a piece of sheet metal or metallic plate which should be level. Directly on top of this, with the gelatine side upwards, place an ordinary photographic glass plate. It goes without saying that this operation must be carried on in red light, or else the photographic plate will be spoiled. It is also necessary to carefully blind with black cloth the vibrator of the spark coil so the white spark will not cast light upon the plate.

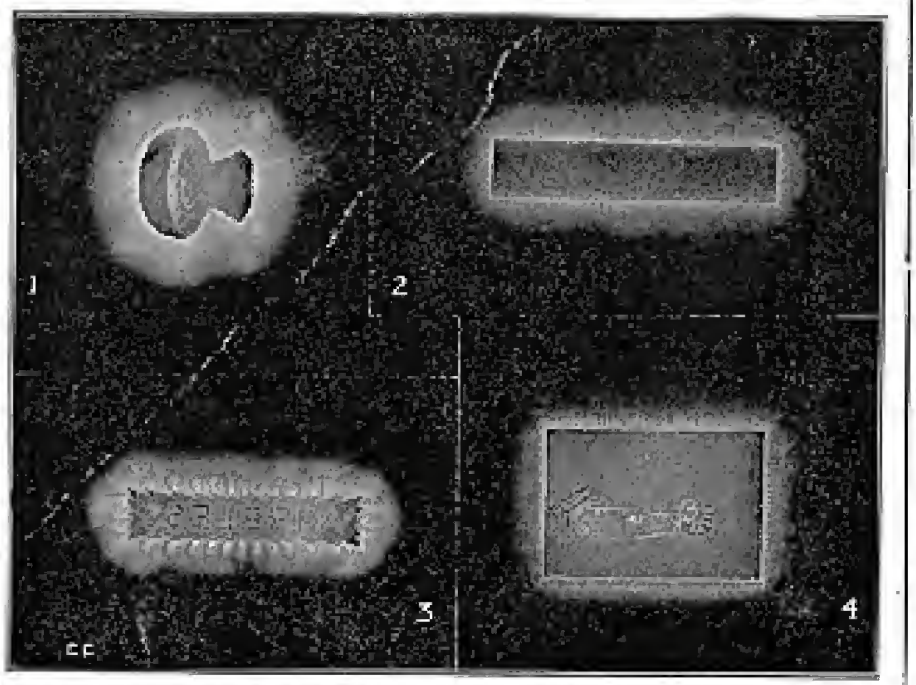
When everything is ready, take the metallic object which is to be pictured by electricity and place it face down directly on top of the photographic plate, so it is in contact with the sensitized gelatine. If the object is square or round without any relief on its face, the negative when developed will show a gray square or a gray round spot. If, however, an object with a relief such as a coin or similar metal object is used, and the plate is developed, subsequently, it will show faithfully all the details which the original article has.

When making spark pictures it should be remembered that a short spark only should be made, and should under no circumstances last longer than a second. Just starting the vibrator for a fraction of a second will usually give best results. Pictures taken with more than two seconds duration usually come out too black.

The philosophy of spark pictures is as follows:

When a spark is made the electrical current passes between the object and the metallic plate underneath the photographic plate, the three acting like a condenser. Wherever the metal touches the plate upon developing the negative will show a black spot at that point. When the negative is printed on paper this process is, of course, reversed, and whatever is black on the plate will be white on the paper and vice versa.

The pictures as shown in this article were taken by H. Gernsback, and the following explanation is given. Up to this time no pictures were known to have been taken of common electrotypes or zinc cuts such as are used for printing purposes, and it occurred to Mr. Gernsback that good results might be obtained if such plates were used. The illustrations show the result.



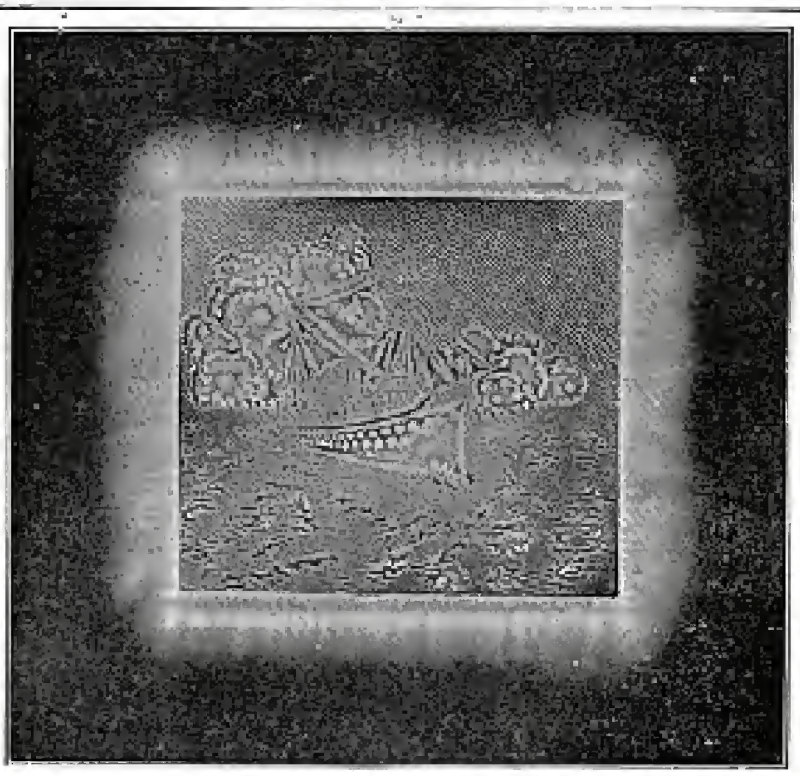
Some Cut of the Ordinary Spark Pictures. (1) Made from Electrotype of Microphone, (2) Steel Rule, (3) Electrotype of "Wireless," (4) Zinc Line Cut of Arm and Hand.

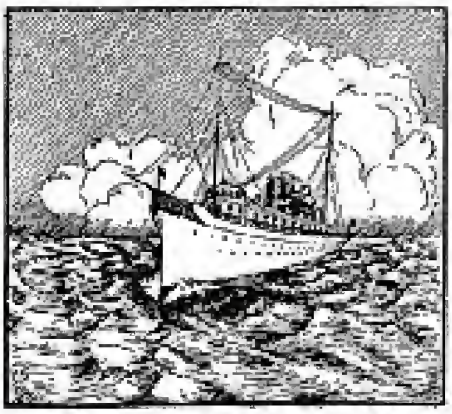
Fig. 1 shows an ordinary line cut, copper electrotype of a microphone which was placed face down upon the plate. The result is clearly shown.

In Fig. 2 an ordinary three-inch steel ruler was used, and in the original photograph all the details down to the division of 1/64 of an inch were clearly shown. These details and also the details of the other three photographs have been lost in the half-tone process by making the plate for printing the illustrations in this magazine.

Fig. 3 shows another copper electrotype with the word "wireless" on it.

Fig. 4 shows an ordinary zinc cut illustration. This cut originally illustrated an article on page 56, June issue of this magazine. It shows much clearer in the orig-





Above: Original Zinc (Line Cut) from Which Spark Picture at Left Was Made.

At Left: Beautiful Spark Photo Made from Zinc Cut Shown at Right. Note Port Holes "Illuminated" by Spark Effect.

final print. As will be seen, everything is reversed, i.e., white is black and black is white.

The auroras which show around the illustrations are simply stray sparks during the time the spark was made.

Fig. 5 shows a unique spark picture made with the above process, and this also was a zinc cut, and was originally used in the *Electrical Experimenter*, page 82, June issue. We reproduce the original cut so it may be compared with the spark picture. It will be noted that a curious effect is produced, and attention is called to the part holes which seem lighted up, whereas in the original they only show as points. The explanation is that these sharp points when they made contact with the plate blackened the latter at these points, and when the print was made they, of course, appeared in white. It will be seen that the electrical spark reproduces every detail of the picture down to the most minute detail.

Half-tone cuts were tried but without obtaining results for the reason that the multitude of points which make printing possible were too fine and too near together and the resulting picture therefore appeared simply as a blur.

NEW TALKING MACHINE UTILIZES COMPRESSED AIR AMPLIFIER.

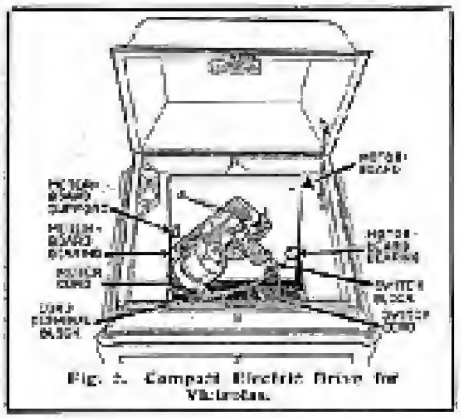


Fig. 2. Compact Electric Drive for Victrolas.

A new talking machine, which is known as the "Auxetophone" and constituting one of the well-known "Victor" line, is shown in our illustration herewith at Fig. 1.

As at present supplied, the Auxetophone constitutes an amplifying phonograph. It utilizes regular disc records, the same as any talking machine of the "Victor" type, and the sounds as given forth from the records and through the regular stylus needle on the phonograph arm are caused to *intensify* on a special air valve hooked up with a compressed air tank, as illustration shows.

A compressed-air blower is driven by an electric motor, as perceived, and the machine is equipped either for direct or alternating current, as the service may require.

The motor is directly connected to the blower, which furnishes air for the pneumatic sound-box, in which the volume of the sound is augmented or amplified. An oil condenser is mounted on top of the blower, as shown, which is connected by a flexible tube to an air-pressure equalizing tank. A flexible tube connects to the top of the tank and leads to a filter. From the filter another tube leads off to the tapered arm equipment, which includes the taper tube leading to the horn. The tube is finally connected to a pneumatic sound-box.

The turntable of the machine, which holds the disc records, is in the present

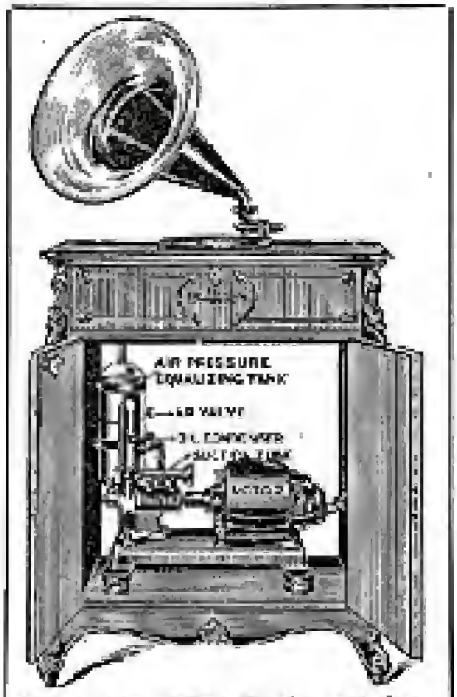


Fig. 1. New Talking Machine with Compressed Air Amplifier.

style operated by a spring motor; but of course it is readily fitted with an electric motor drive.

The second illustration shows the latest model Victrola, equipped with electric motor drive. This machine has no connection with the one aforementioned, known as the Auxetophone. A very neat and readily accessible method of mounting the electric motor drive for the standard Victrola is observed from the sketch, Fig. 2. The top table-board, containing the record holder or turntable, etc., swings on pivots, as observed, so that the motor and its speed governor, etc., become at once accessible for repairs, oiling and other attention by simply pushing a button.

NEW TELEPHONE SET FOR AVIATORS.

Our two illustrations herewith show a new style telephone set, known as the "Aero-Phone," and particularly designed and intended for the use of aviators. Its express purpose is to permit the aviator and his mechanician or passenger to talk to each other freely without being in any way interfered with, due to the excessive noise of the engine, etc.

The Aero-Phone in Use.

These aero-phone sets utilize a regular head-band, specially made and carrying two compact type watch case receivers, as observed. These receivers are held against ears by the spring head band, so that practically all of the extraneous disturbing noises are thoroughly excluded. The spring tension, however, is so arranged that the entire outfit is not in any way uncomfortable for the wearer of the phone. Special microphone transmitters are provided with soft rubber caps on each, strapped to the chest at a point below the collar bone and above the third rib.

In speaking the chest muscles transmit the exact vibrations to the transmitter, thus enabling telephone conversation to be carried on comfortably between the two occupants of the aeroplane. The microphone is thus not placed before the mouth.

The telephone receivers and transmitters are connected by flexible cords, which terminate in a small plug. When the aviator or passenger takes a seat the plug is inserted in a jack mounted on the framework of the aeroplane. The only battery current required is that furnished by three regular dry cells, which will provide continuous service for 100 hours without any appreciable loss of transmission quality.

Aviator with Aero-Phone, Talking Through His Shield.

This perfected telephone set for aeroplane use is of great interest, particularly for military aeronautical applications.

BRONX RADIO CLUB.

The club is composed of 21 enthusiastic members, most of whom have stations of their own. Those wishing to further their knowledge of the subject are instructed by the more advanced members.

Officers are as follows: M. Huber, president; H. Bertin, vice-president; L. Brodie, secretary; A. Richter, treasurer; J. Smith, business manager.

Communications from other clubs and individuals should be addressed to L. Brodie, secretary, 1382 Boston Road, Bronx, New York.

Electricity and the Modern Automobile Torpedo

By Samuel Cohen

AMONG the most ingenious weapons of modern warfare is the automobile torpedo, a cigar-shaped shell constructed entirely of steel, with an electro-mechanical brain and carrying a high-explosive gunpowder charge.

This self-propelling device, is shown at Fig. 1 with its clever devices for steering and diving. It measures 22 feet long and 21 inches in diameter, with a weight of one ton. This modern fighting machine consists of three parts, viz., a War Head, carrying 250 pounds of high explosive; the central Flask, charged with compressed air at 2,250 pounds per square inch, and an after-body or Tail, in which the propelling and controlling mechanisms are enclosed.

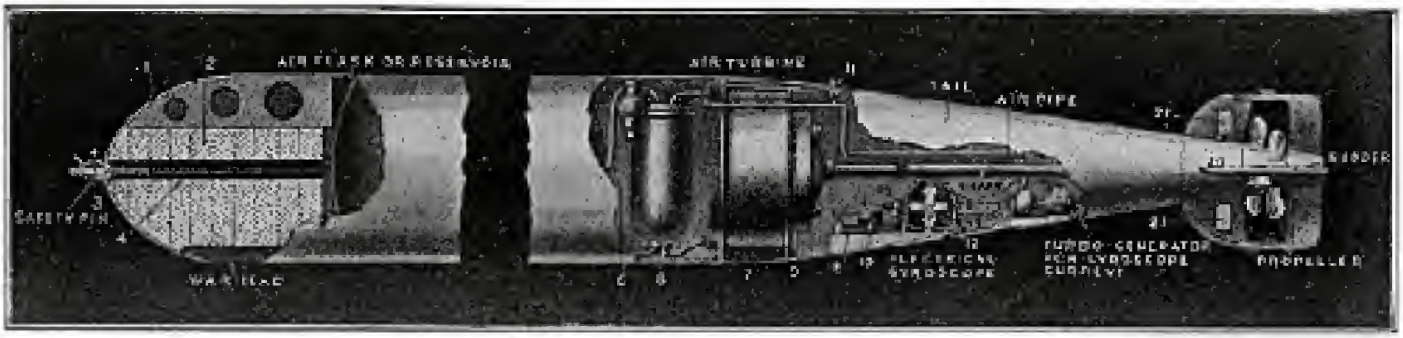


Fig. 1. Semi-Sectional View of Latest Type Automobile Torpedo. (C) Experimenter Pub. Co.

The "war-head" (1), Fig. 1, differs from the "practice-head" and is used only in actual fighting. It is loaded with a charge of guncotton (2) containing 25 per cent. moisture. At 4 is the detonating charge, which is fired by the plunger or striking rod 3. A safety pin is provided at the end of the plunger, as depicted, this being used for safety when loading the torpedo in the firing tube.

The central flask or air reservoir 6 (Fig. 1) is connected to the turbine through the superheater 8. This turbine is connected to a reducer gear 9 and then to the propeller shaft 10 which operates the two propellers 22, 22. These are rotated in opposite directions. The power developed by the turbine is 110 horse-power and the shaft runs at 1,200 R.P.M., enabling the missile to travel at the rate of 35 to 40 knots, with an extreme range of 10,000 yards.

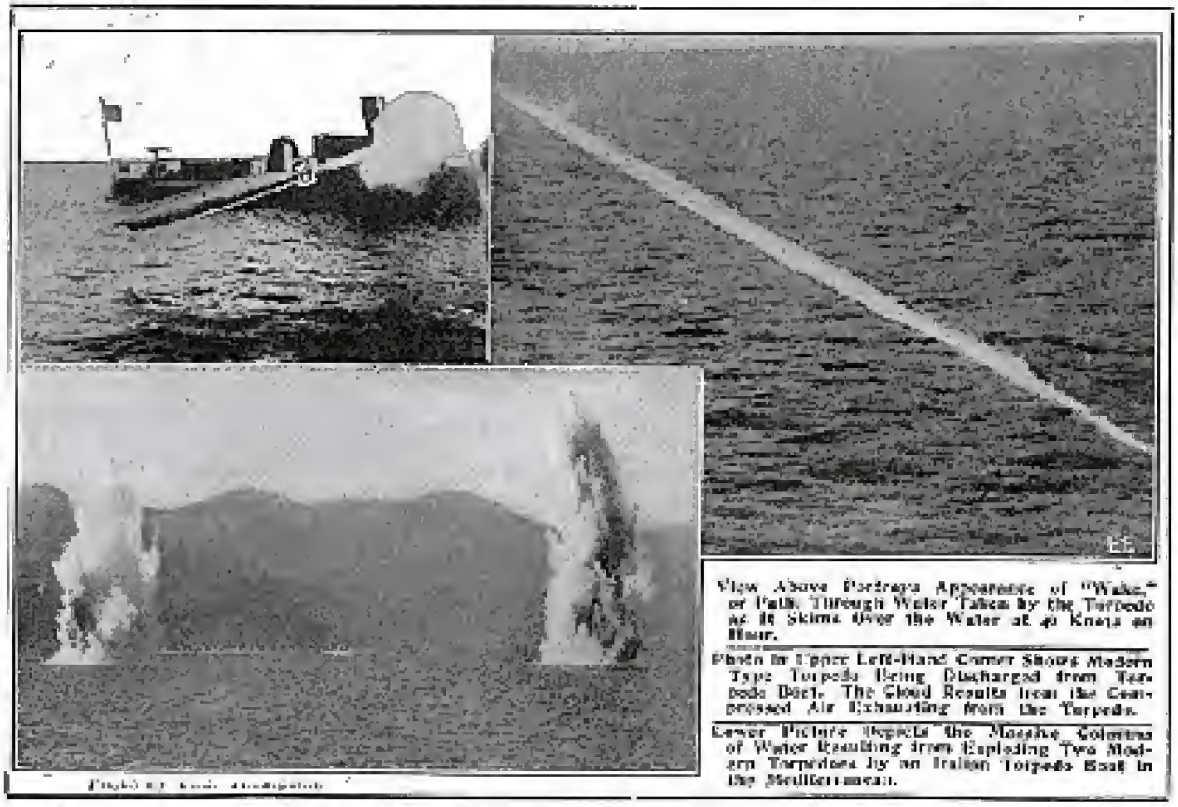
It is in the "Tail" that the brain of the weapon is installed, and the little electric gyroscope 16, which a few years ago was considered a toy, steers the torpedo to the right or to the left. It is an almost human pilot and steersman, so to speak. The gyroscope herewith shown, is entirely driven by electricity, supplied by a small turbo-dynamo set. The turbine itself is operated by compressed air from the air flasks 6. This electrically operated gyroscope consists of an alternating current induction motor, with its rotor and stator 12, while 13 is a gimbal ring. The gyroscope wheel acts upon a small crank lever 15, which is connected to the control lever 16, operating the vertical rudders 21.

As is well known, a gyroscope will always attempt to maintain its center of gravity with respect to a certain point or angle. That is to say, if we have a wheel of any type revolving at very high speed in a certain position, with respect to its axis of rotation, then any effort to change the plane of this wheel, in so far as its rotation is concerned, will be found to cause considerable effort necessary in order to accomplish this change. Thus, the gyroscopic principle is brought into play in order to keep the modern automobile torpedo in a true course. As becomes evident, and especially when the water is very rough, it is practically impossible to discharge one of these high-speed torpedoes with a "fixed rudder" or steering gear set same, which shall cause this weapon to absolutely maintain its natural course along a straight line, as was previously intended when discharging same.

Therefore when the torpedo shell is deflected from its course, even to a slight degree, by tidal or wave currents, etc., it will be maintained in practically a *dead straight course* by the correcting action of the electrically driven gyroscope.

The rapidly revolving gyroscope element 12 will, as seen from the foregoing description, tend to rotate from in the same axial plane as at the moment previous to the deviation of the torpedo's true course. Hence the gyroscope will swing about, so as to maintain its original plane of rotation, even though the hull of the torpedo may be pointing several degrees off its true course at the moment due to interfering water currents, etc.

When the rotating gyroscope element 12 makes this swing about its plane it will carry the gimbal ring 13 with it. On this ring is a trigger release cam which, as the ring 13 moves around, allows the spring-actuated cam rod 14 to slide forward.



View Above Portrays Appearance of "Wake," or Path, Through Water Taken by the Torpedo as It Skims Over the Water at 40 Knots an Hour.

Photo in Upper Left-Hand Corner Shows Modern Type Torpedo Being Discharged from Torpedo Boat. The Cloud Results from the Compressed Air Exhausting from the Torpedo.

Lower Picture Depicts the Massive Columns of Water Resulting from Exploding Two Modern Torpedoes by an Italian Torpedo Boat in the Mediterranean.

When this cam rod slides forward, as described, it ejects or pushes upward the rudder control trigger 16. When the torpedo has been thus automatically brought back into its true course it will be seen that the gyroscope will then have its gimbal ring 13 brought back into its normal plane, and in so doing it will, of course, reset the cam rod 14 to its normal position, and so on.

The depth of the torpedo is regulated by a depth-control mechanism 17. It consists of a metallic diaphragm 18, actuating lever 19 and in turn operating the rudders 20. This device is usually "set" for 15 feet below the surface of the water, so that when the tube is fired it will go below this mark, but the diaphragm immediately is actuated by the greater pressure of the water and in turn lowers the rudders 20, which raises the torpedo to its proper level.

A new method of controlling the depth of torpedo tubes has been recently acted which employs electricity. This is kept secret at present and information on the details of this system is unavailable now.

The torpedoes are launched from a discharging tube by an impulse charge of compressed air. As soon as the torpedo is launched the trigger 11, at the center of the flask, is released, which disengages the high pressure valve of the reservoir and the turbine, and in turn operates the two propellers. As soon as the torpedo strikes the water it submerges to the proper depth and rushes with a mad pace straight to its target.

One of the latest 21-inch diameter automobile torpedoes of the Bliss-Leavitt type is shown in Fig. 2. This complicated machine costs nearly $8,000 to build. Uncle Sam is now expending large sums of money in building these weapons, and the Newport naval factory is turning out about 100 of them annually. These fighting sea machines have proven a great success, as shown in the present European conflict.

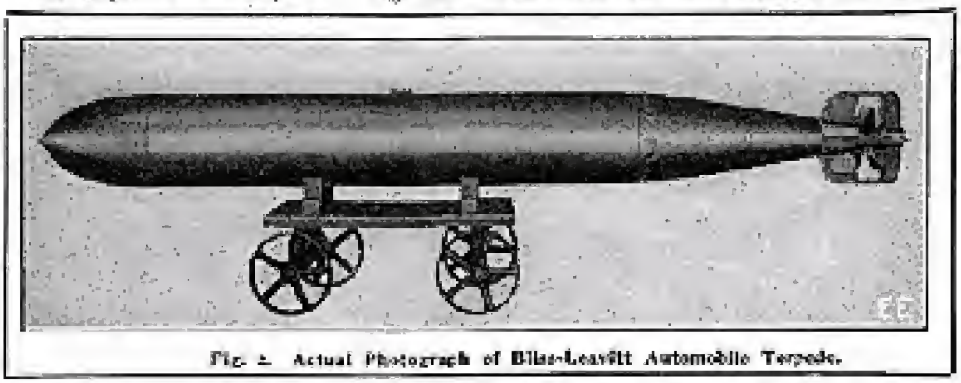
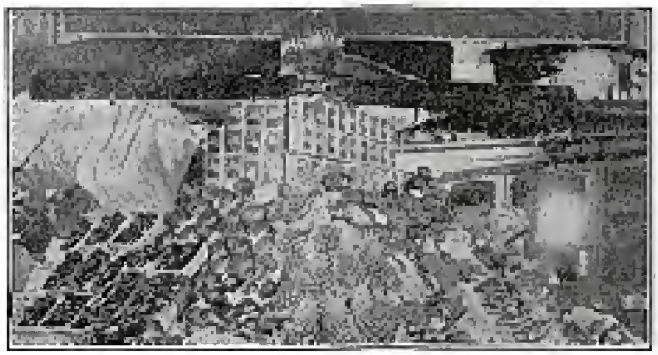


Fig. 2. Actual Photograph of Bliss-Leavitt Automobile Torpedo.

NEW FLY CHASING CEILING FAN.

The photograph portrays a new fly-chasing electric ceiling fan recently installed in the Reading Terminal Market, Philadelphia, Pa., and at present there are 42 of them in operation. The fans are a special type made up for the purpose, running at 150 revolutions per minute and with a very slight pitched blade so there is practically no breeze developed by them. The blades have a sweep of 90 inches. The purpose of the fan is simply to throw a moving shadow on the meats, fruits and vegetables to scare the flies away.

These fans have the advantage over an ordinary ceiling fan with a high speed, in that the ordinary fan causes meats to become black and also hastens the decay of fruits and vegetables, while this new design gives very little breeze and does not affect them. Flies are also in evidence where the ordinary fan is used, but the shadow effect scares the flies and has completely solved the problem for market-house people.



The Shadow, Not the Breeze, Chases the Flies.

Thus a little science added to practise has apparently solved a very troublesome problem.

TENNESSEE TRI-STATE FAIR TO HAVE RADIO.

Visitors to the Tri-State fair at Memphis, Tenn., who want to send their regards to the Kaiser or Kitchener can step into a wireless office, write out the message, pay a fee of a few dollars a word, and let 'er zip.

This became known recently when Frank Fuller, secretary of the fair association, stated that the Tri-State Wireless Association was going to install a service branch at the fair grounds.

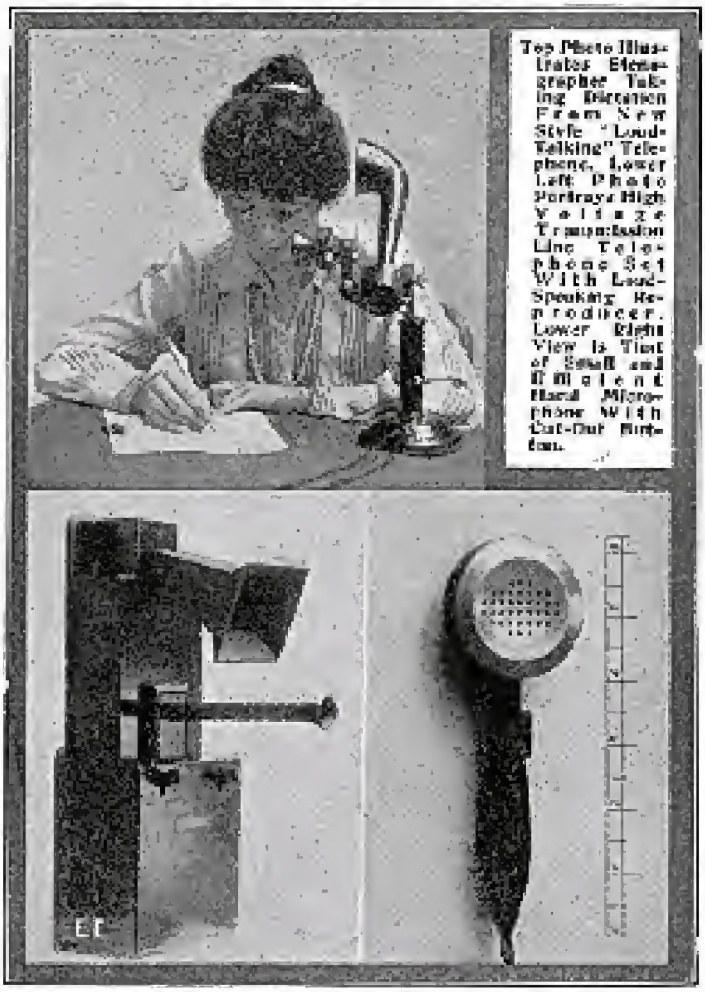
An aerial will be erected and apparatus with sufficient power to give the visitors an idea of what a real wireless station is, will be installed.

MODERN APPLICATIONS OF THE LOUD SPEAKING TELEPHONE.

The "loud talker," or more properly the loud-speaking telephone, is now being extensively employed in places where the ordinary telephone cannot be used, and the illustrations herewith presented depict some novel applications. Fig. 1 portrays a stenographer taking dictation from her employer by means of these loud talkers. The transmitter is placed on the left of the apparatus, as seen, and is utilized in ordinary talking, as for instance, when the stenographer desires repetition of a sentence, etc.

This method of dictating is very efficacious as a time saver, and eliminates the use of a buzzer or bell in calling the stenographer.

Fig. 2 illustrates a field-type loud talker employed in high-tension line work, where the linemen need to keep in constant touch with the switchboard operator at the power station. This instrument is constructed entirely of an insulating material, so that the high voltage of the line does not enter the instrument in proximity to the person talking. The square-shaped horn leads to the receiver, and the long, round tube in the center is connected to the microphone transmitter. The small handles in front are the two switches operating the calling and talking circuits.



Top Photo Illustrates Stenographer Taking Dictation From New Style "Loud-Talking" Telephone. Lower Left Photo Portrays High Voltage Transmission Line Telephone Set With Loud-Speaking Reproducer. Lower Right View Is That of Small and Efficient Hand Microphone With Cut-Out Button.

A miniature hand-style transmitter for general use is shown in Fig. 3. It is of the ordinary carbon-grain type and it measures 6¼ inches long by 2¼ inches and weighs only four ounces. This transmitter can be placed in the regular telephone circuit. A small push-button is placed near the end, as depicted, and is used for calling purposes. These instruments have been developed by the Stentor Electric Co.

Sayville Once More

An Attack on the Electrical Experimenter

THE two letters reproduced herewith require no comment. The one illustrates the German viewpoint, the other the American. We leave it to our readers to decide which is the correct one.

Dr. K. G. Frank, as is well known, is the present executive head of the Sayville wireless station. On August 17 the *Providence Journal* laid before the U. S. Neutrality Board in Washington eight formal charges. One of these charges was that Dr. K. G. Frank is the head in the United States of what is known in Berlin as an Information Bureau (secret service).

The letters follow:

ATLANTIC COMMUNICATION CO.
(Telefunken System of Wireless Telegraphy)
47-49 West Street,

The Experimenter Publishing Co.,
Attention Mr. H. Gernsback, Editor.

Dear Sirs:—With regret and surprise I have read your editorial in No. 28 of *The Electrical Experimenter* on "Sayville."

According to my knowledge your paper is the only technical paper which joins some of the daily newspapers in the contemptible attempt to cast suspicion upon Sayville. One would at least expect that your paper would take cognizance of the fact that not only no single instance of an unneutral act can be proved, but also that there has never been any charge of such act made by any official of the United States Government.

The standard of the technical and scientific press in this country is, fortunately, so high that I am convinced your paper will remain the only one which distinguishes itself in such manner.

Very truly yours,
(Signed) *Dr. K. G. Frank.*
New York, N. Y., August 17, 1915.

Atlantic Communication Co.,
New York City,
Attention Dr. K. G. Frank.

Dear Sirs:—

The writer was indeed surprised to receive your communication of August 17. He is at a loss to understand how you could possibly misconstrue the true meaning of his editorial in view of the fact that at the time it was published Sayville had already been taken over by the Government. What the editorial meant to convey was that even though the Government had taken over Sayville, it was not at all certain that messages pregnant with unneutral information, yet harmless on their face, could not be sent in spite of all censorship. The imaginary case of the message from the "Adriatic" was cited as an illustration. Anyone by paying the usual tolls can even now send such a message. The management or the operators at the Sayville station obviously need not necessarily have cognizance that the message is an unneutral one.

That the writer's viewpoint was correct is best shown by the announcement of Secretary of the Navy Daniels under date of August 18, "that as a result of the demonstration that unneutral messages could be sent through the Sayville station he had issued orders that in all cases where the Government experts were in doubt about any message presented for sending it should be referred to Washington for judgment."

As to the second paragraph in your letter your attention is directed to page 210, September issue of *The Electrical Experimenter*. It gives facts with which you are doubtless familiar. These facts disclose one of the main reasons why Sayville was taken over by our Government.

Your assertion that "*The Electrical Experimenter* is joining some of the daily newspapers in the contemptible attempt to cast suspicion upon Sayville and, further, that no single instance of a dishonorable act can be proved, but also that there has never been any charge of such act made by any official of the United States Government," is as perverted as it is unfounded. Its tone is also resented by the writer. *The Electrical Experimenter* certainly never attempted to cast suspicion upon Sayville, but it has shown that the station can, and perhaps has been used to convey unneutral messages, though not necessarily with the knowledge of the management or its operators.

At the same time the writer desires to voice his opinion that there is sufficient circumstantial evidence at hand to lead anyone who wishes to view the matter in its true light to believe that the management of the Sayville station probably had some knowledge of the real purport of the many "irregular" messages sent over the Atlantic by Sayville before the station was finally taken over by the United States Government.

The slur contained in your last paragraph is best met by bringing to your attention the fact that *The Electrical Experimenter* to-day is considered an authority on wireless matters in this country. As such it is its duty to publish any matter of interest to the wireless world. It will distinguish itself in the future by continuing to do so. It will also continue voicing its opinion especially at times when the welfare of this country is concerned.

Very truly yours,
The Experimenter Publishing Co.
(Signed) H. Gernsback, *Editor.*
New York, August 20, 1915.

$2,500.00 Edison Day Contest for Boys and Girls

Edison, the Wizard of Menlo Park, whose name is mentioned with reverence by all for his inventive ability, has always been liked by his fellow townsmen. It was his invention of the incandescent lamp 36 years ago that will indirectly cause him to be equally liked by thousands of boys and girls throughout the country.

From the crude little carbon filament lamp that made its initial bow to the world on October 21, 1879, it has rapidly advanced to the modern high efficiency tungsten filament lamp of to-day known universally as the *Mazda*.

The manufacturers of the modern form of this lamp are planning a unique advertising campaign that will enable numerous children to win, in all, $2,500.00 worth of valuable prizes.

These lamps are so saving of current and give such satisfying results that not to use them is a loss of money to the storekeepers and the householders; therefore, to introduce this lamp more widely this special campaign was organized. It is understood, of course, that you must live in a town having electric lights, but if you live sufficiently near a city you may enter the contest.

The plan outlined is as follows: You obtain cards from the local agent for Edison Mazda lamps and after signing your name in the proper space thereon you distribute them to persons whom you think can be induced to use the lamps. You get as many cards as you think you can distribute, then go in to "win." Make a list of people and visit them. Learn all you can about the prices and different sizes of lamps, so as to be able to talk intelligently on the subject.

Instruct the people you visit that they are to hand in your card with their order for lamps, so you can see it is necessary to get into action before another boy or girl can get in ahead of you. Don't distribute your cards before the 21st of September, although you can obtain the cards before that date.

Any further details are explained by the Conditions:

1. You must be under 18 years of age.

2. You must live in or near a town having electric light.

3. You must get a number of cards from the local lighting company or agent for Edison Mazda lamps.

4. You must sign your name and address to all the cards.

5. You must distribute the cards to users of electric light in homes, stores, factories, etc., from September 21 to October 21, 1915.

6. The cards will be returned to the lighting company or Edison agents as orders for Edison Mazda lamps at any time between September 21 and October 21, 1915.

7. A watt is a point. For example: A card with your name on it is turned in as an order for four 40-watt Edison Mazda lamps. This credits you with (4x40) 160 points.

8. After October 21 the lighting company or Edison agent turns in all the cards to the Edison Lamp Works of the General Electric Company, Harrison, N. J.

9. The cards are sorted and the boy or girl whose name appears on cards totaling the greatest number of watts or points gets first prize, the next largest the second prize and so on down.

10. In case of a tie by two or more contestants, each one will receive the prize.

11. The prizes will be distributed by the Edison Lamp Works of the General Electric Company as soon as the cards are counted and the winners determined.

12. No prize will be awarded to any employe of the General Electric Company, lamp agent or lighting company.

You have the plan before you, now mobilize your forces, bring up your artillery, for there's an *Indian motorcycle* for first prize for the boys, and an Edison diamond disc *Phonograph* as first prize for the girls. The other prizes for boys run all the way from a row-boat motor to baseballs and gloves, including canoes, watches, boxing gloves, rifles; and girls' prizes include mandolins, wrist watches, electric chafing dish, toasters, desk sets, fountain pens. A host of valuable articles, all told, and 2,000 flash-lights are to be given away.

It will require some work, but you will enjoy it as much as the premium you will win.

THE CONSTRUCTOR

Construction of an Inductive Tuner.

By Milton B. Sleeper

IN the design of this tuner are incorporated all the advantages of the larger, more awkward designs, in a compact enclosed form, having a *continuous control* for the sharpest tuning by simple adjustments. With the regulation size an-

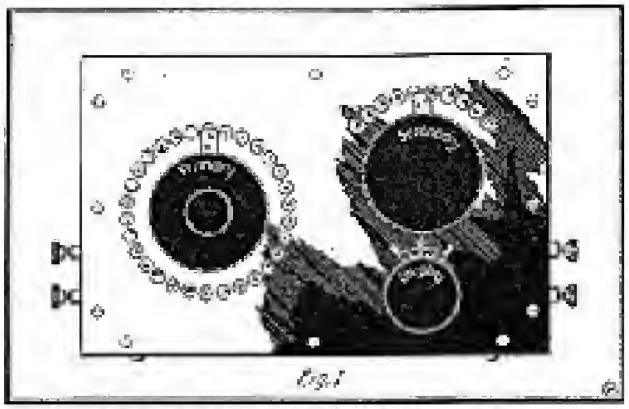


Fig. 1

Fig. 1. Front View of Completed Coupler.

tenna it will bring in signals over 1,200 meters; the largest range any tuner can have without being affected by dead-end losses. Fig. 1 shows the unique tuning control. On the large 30-point switch every fourth turn of the primary is tapped, while with the compensator handle, in the middle of the other, three turns can be added, one at a time. This gives the sharpest tuning possible in the simplest way. Taps from the secondary, 10 in number, are brought to the right hand switch. The coupling, while sliding, is adjusted by rotating the handle 90 degrees, giving to this type the advantage of the variometer. Although it has ample variation of coupling, it is a very compact instrument. To keep the coils from being affected by the atmosphere, and to protect the working parts from dust it is enclosed, except for the controls. These are closely grouped on the front of the case. Tuning can be done many times quicker, with less effort than is required with the ordinary type, where the primary switch or slider is at one end, the secondary switch at the other, while a movement of 5 or 6 inches is required to vary the coupling.

At the conclusion of the article is an entire list of parts, with their size, number, material, etc. Using this list, all the rough materials should be bought before any actual work is done. Then do not put any pieces together until they are *all completed*. Follow the drawings closely, otherwise the pieces will not fit.

Coils.

Cores.—These are shown sectionally in Fig. 2. While ordinary mailing tubes can be used for the cores by changing the diameter of the inside pieces, this not at all advisable; the drawings are for tubes made by Beetle & Maclean. As they are not made just the right size, they must be purchased oversized. Get one 7¼x3 5/16x4 inches and one 7⅝x3⅝x5/16 inches. First cut them 3½ inches long with a hacksaw, then finish the tubes to the proper length with sandpaper on a large block. As the larger coil is too small inside, it must be worked out with sand paper or a coarse file to the required diameter. Keep the walls uniform in thickness. One-sixteenth of an inch must be taken from the outside diameter of the smaller core. This is to allow room enough for them to slide. After the cores are brought to size, rub them smooth with fine sand paper. Do not shellac or in any way moisten or heat the tubes, as this causes them to expand. After two or three weeks they shrink again, and if the coils are wound the wire loosens. One-half pound of No. 24 double silk-covered wire is required for the primary.

Primary winding.—Begin at the left-hand end to wind. To start the winding, make two small holes one-sixteenth of an inch from the end of the tube. Put the end of the wire from the outside into one hole and bring it out the other, leaving the loose end 6 inches long for connection. It is best to run the wire over a series of spools on spikes pounded into a flat board. This keeps the wire tight without rubbing the insulation. Hold the coil in your lap, facing away from the spool of wire. Turn the coil with one hand and guide the wire with the other. Do not turn the wire around the core, as this makes kinks.

The taps are made in the following order: beginning of winding, end of first turn, end of second turn, end of third, 7, 9, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 88, 92, 96, 100, 104, 108, 112, 116, 120. (1) Fig. 5 shows the method of making taps. The taps should be made in a straight line down the coil; however, the first ones should be staggered a little, so the bare wires will not come in contact with each other. Be careful in scraping the insulation where the taps are twisted (see Fig. 6) not to cut the wire. By scraping the wire in this way losses from taps are minimized. Leave a good 6 inches for connections to the switch. It is well to put a little sealing wax over the wire where the taps are made. When the winding is complete fasten the end through two holes as before, leaving enough for connection. Next, cut up four strips of thin cloth, 4 inches by ½ inch, and soak them in fairly thick shellac. Then lay them lengthwise on the winding, 90 degrees apart. Cut off the ends of the cloth even with the ends of the tube; do not turn them under. This

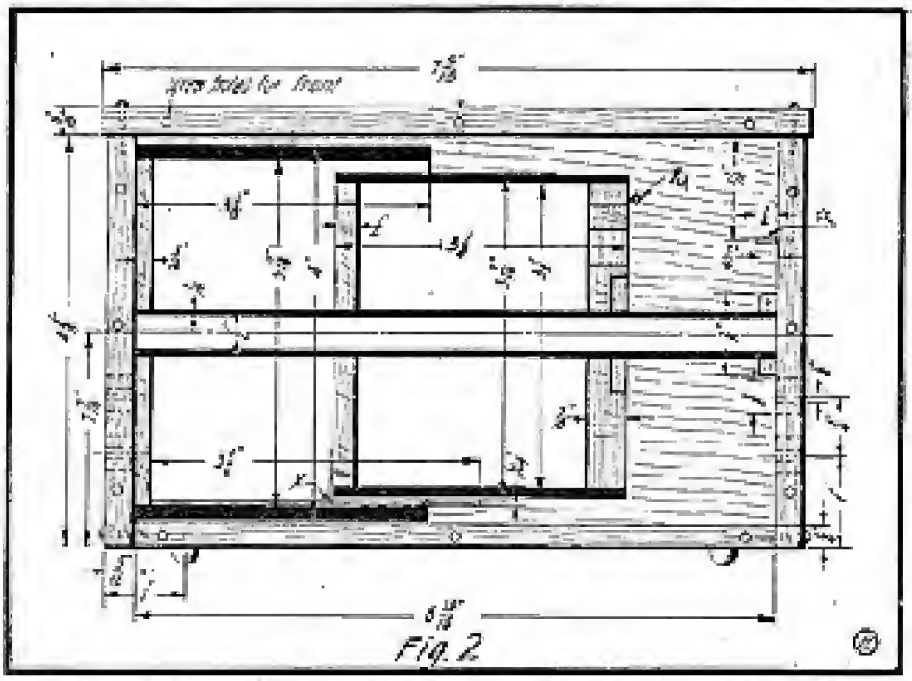


Fig. 2. Sidewise Sectional View of Coupler, Showing Primary and Secondary Coils.

will keep the wire tight without shellacking it all over. Inside the core at the bottom, 90 degrees from the line of taps, glue the two guides 1/16 of an inch apart (Figs. 2 and 3, which will keep the secondary

from turning. Be careful they are *perfectly* parallel with the axis of the core.

Secondary.—One fourth pound of No.

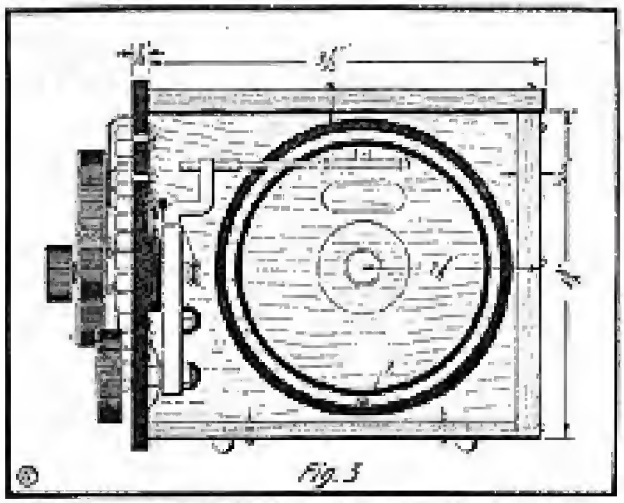


Fig. 3. Assembly of Primary and Secondary Coils in Cabinet.

28 double silk covered wire is required for the secondary coil. The taps (see (2) Fig. 6) are made differently. Instead of coming from the outside, they must come from the inside of the core. Beginning 1/10 of an inch from the end of the secondary core, mark off 3/10 of an inch 10 times. At these points make holes just large

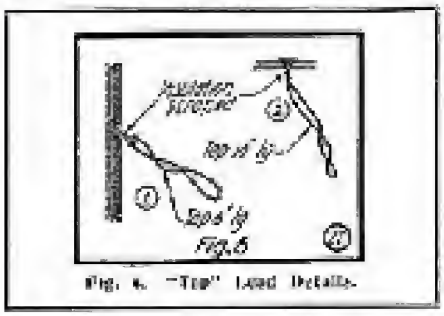


Fig. 6. "Tap" Lead Details.

enough to slip the wire. There are 14 turns of wire between these holes. If the holes are made right and the wire is tightly wound this will be just the right distance. These taps must be at least 50 inches long. Put thin strips of cloth with shellac on this winding also.

Cabinet Details.

The dimensions for the case are given in Figs. 2 and 3 and in the list of parts. Each piece must be perfectly accurate or the case will not look well nor will the other parts fit in it properly. Put the bushings in from the *outside*; then it will not matter if the wood is chipped in forcing the bushings into the holes. The staple N in Fig. 2 is 1¾ inches long. Drive it into the end-piece before the case is assembled. An excellent finish can be made with a dark mahogany stain. When it is perfectly dry apply three coats of thin white shellac and rub it down with finest sandpaper covered with linseed oil. This gives a dull, durable polish. The rubber feet on the bottom prevent the case from scratching the table and keep the case up to allow for the overhang of the front.

Primary Switch.

The parts of this switch must be turned out exactly. Fig. 4 gives the details. (1) shows the underside of the handle; (2) is a section through the switch; (3) is the back side of the switch, showing the compensator. The large switch contact is made of three thicknesses of No. 30 spring brass. This gives a better contact than can be had with a single piece. It is fastened to the plate by a screw threaded into the handle. The plate is held to the center piece (D) by a little drop of solder. Connection is made by soldering a strip of copper to the spring (A) under the centerpiece. In this way connection is made to the switch-points through the switch contact, plate, centerpiece and spring. The handle must fit tightly over the end of (D) to keep it from slipping. The insulating tube (C) is forced into (D), but the compensator rod (B) must turn easily in the tube. The four switch-points for the compensator are made of round-head 8-32 screws, their heads turned down 3/16 inch in diameter and 1/16 inch thick. Then lugs for the taps are fastened under the heads of the screws. To keep the compensator switch contact from turning off the points it is necessary to put in a stopping pin at each side. The spring (A) must be strong to hold the switch together. The nuts which hold the compensator contact must not be screwed too far down or the compensator handle will bind. Get all the switches fastened to the front and in working order before fastening any taps.

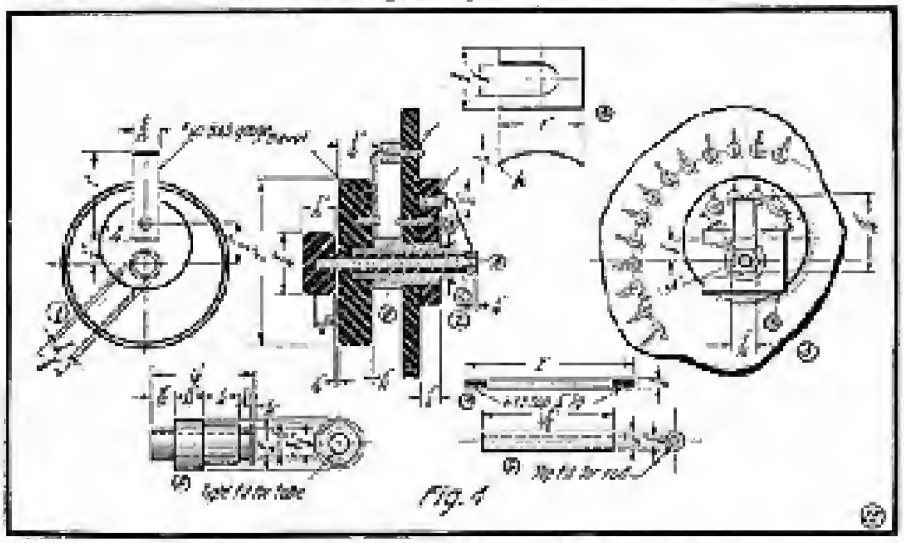


Fig. 4. Parts Making Up "Primary" Switch of Coupler.

Secondary Switch.

Fig. 5 gives the dimensions of this switch. This contact is also made with three thicknesses of brass strip. The connection is made by a copper strip soldered to the spring on the back side. Although it is not necessary, it is best to knurl and bevel the edges of the handles as Fig. 3 shows.

(To be continued.)

TREATMENT FOR SULPHATED STORAGE BATTERY PLATES.

A great many experimenters have storage battery plates on their hands from time to time which have become badly sulphated as indicated by a tenacious white coating, which gathers on the surface of the plates. Of course this renders them practically inactive so far as the regular function of the storage battery is concerned.

A method not generally known is described below for the treatment of such sulphated plates, but great care should be exercised in using this method in the thorough washing of the plates after the bath below mentioned has been utilized.

Before replacing the plates in the battery they should be washed 12 to 15 times in different changes of water or placed for a considerable period under a running water spigot, or otherwise any remaining ammonium acetate in the plates would cause them to disintegrate when the battery was again put in service.

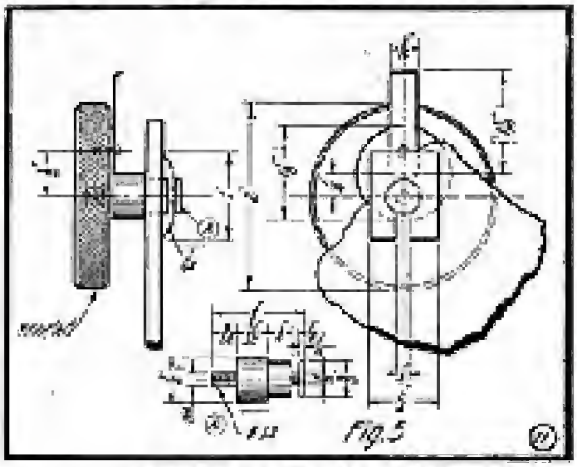


Fig. 5. Details of Secondary Switch.

This special sulphation treatment "bath" is made up of about one-half pound of ammonium acetate, dissolved in one quart of water and put in an earthenware jar. The lead storage battery plates requiring treatment are immersed in this solution for about one-half hour, and they should be kept hot during this period by a gentle flame placed under the jar. The plates will now become freed from the sulphate coating, and they are then afterward removed from the jar and very thoroughly washed as previously explained. The ammonium acetate can be purchased at any drug store or chemists' supply house and is fairly cheap. A larger bath solution may be made up, of course, following the above proportions.

HOW TO CLEAN BRASS.

Brass instruments or parts thereof that have become tarnished from exposure to air may be cleaned in the following manner: Boil for a few minutes in a solution of one ounce of alum to every part of water. Then polish with any kind of brass polish, or even a dry cloth will do. This will remove tarnish from all crevices where other means have failed. S. C. V.

ELECTRIC IGNITION SCHEME FOR GAS RANGES.

The electrical experimenter may put some of his ideas to a good purpose in rigging up an electric ignition system on the kitchen gas range. Two methods are suggested in the drawings herewith, at Figs. 1, 2 and 3.

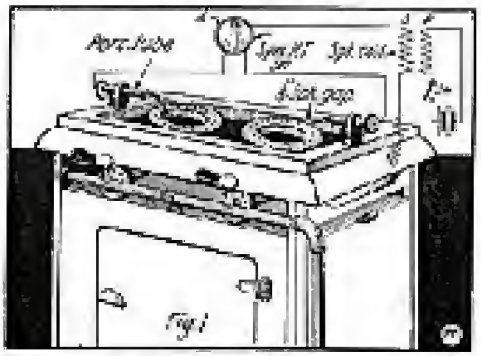


Fig. 1. "Jump" Spark Applied to Gas Range.

At Fig. 1 is indicated the connections for utilizing a small jump spark coil of about ½-inch rating, together with battery and primary switch, and also the specially insulated secondary switch. The secondary wiring for the jump spark circuit to the burners should be made with high tension or automobile engine cable. Ordinary wire may be used, as sketch shows, by leading this wire through porcelain tubes suitably secured to the top of the stove. Two or more burners may be provided with spark circuits by using two or more switch points on the high-tension switch A. This switch should have good spacing between the points and the blade on same should be about 4 inches long. It should be provided with a hard rubber stem and handle, so that the hand will be several inches away when manipulating same.

As evidenced from diagram, Fig. 1, both the primary and secondary switches have to be manipulated when the gas is turned on in the burner. The spark jumps from the wire (at the end of the porcelain tube), which is placed over one of the small holes in the burner, to the burner itself. One side of the secondary winding of the coil is grounded, at G, to the stove frame.

It is very easy to rig up an automatic primary switching stunt for this outfit using a jump spark coil, as shown at Fig. 3 in detail. The one primary wire is joined to the iron frame of the stove and the other primary wire connects to an insulated copper or brass wipe spring, as observed. A metal pin, such as a machine screw, tapped into the knob of the gas valve handle makes contact through the first part of its swing with the wipe spring. Thus the primary circuit is closed while the gas valve is being first turned open and the secondary spark from the coil jumps at the burner, igniting the gas. As the valve handle is opened further it breaks contact with the wipe spring and the spark is cut off. The secondary H. T. switch still has to be used for the different burners.

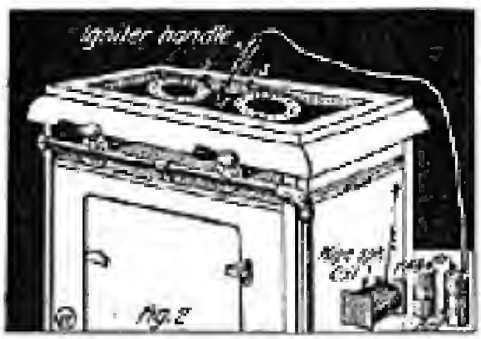


Fig. 2. "Wipe" Spark Applied to Kitchen Gas Range.

At Fig. 2 is shown a common system used in shops and readily adaptable, of course, to the kitchen gas range, whereby a common "inductance" or "kick" coil is utilized in series with a battery. The spark produced in this way is a "wipe" spark, as it is commonly termed. To create the spark a metal-tipped handle T is used to make and break the circuit against a sparking wire or point over one of the holes in the gas burner, as at S S. This wire S may be a piece of steel or German silver stock.

In operation the gas is turned on and directly after it, the igniter handle T is passed across the spark point S, thereby producing a "wipe" spark, which ignites the gas. A battery of four dry cells is usually sufficient and ordinary bell wire may be used in hooking up the circuits between the battery, stove and coil.

Inductance spark coils may be purchased cheaply at any electrical supply store and are commonly known as "gas lighting coils." It also may be made up from an iron wire core about 9 inches long by 1 inch in diameter. This core is provided with two wooden discs at the ends about 2½ inches in diameter and the core is covered with several layers of heavy paper. Over this is wound 8 to 10 layers of No. 14 cotton-covered or enameled copper magnet wire. This coil will serve for all kinds of gas ignition, utilizing the "wipe" spark principle. Contributed by

JOHN GALLAGHER.

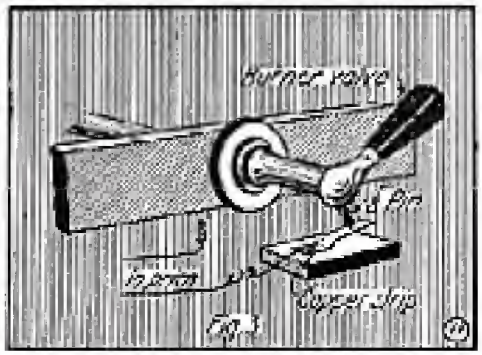


Fig. 3. Detail of Automatic Gas Stove Igniter Attachment.

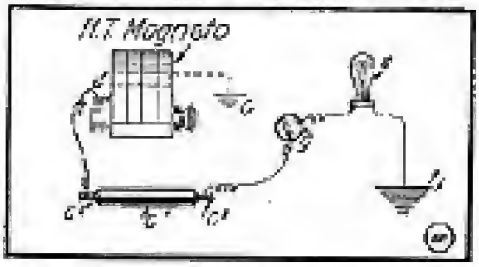
ELECTRIC LIGHT FROM HIGH TENSION MAGNETOS.

With the advent of magnetos for the purposes of ignition in internal combustion engines, the thoughts of motorcycle and automobile manufacturers turned to the possibility of introducing in a satisfactory manner, some means whereby the electric current generated by the magneto, could be utilized for illumination, as well as for ignition.

Accordingly, various devices to effect this happy combination have been given birth, and one of them because of its simplicity of construction and operation, is worthy of consideration.

The device is of recent invention and is the subject of an English patent. The principle the inventors have worked upon is that of transforming the voltage at the primary terminals of the magneto down to that of the lamp to be used. The invention accordingly consists of a resistance in the form of an iron core choking coil, *c* together with an incandescent electric lamp *e* (preferably of the metallic filament type) connected between the primary winding *a* of the magneto and the particular means employed to earth one end of this winding, say at *f*.

A convenient arrangement is shown in the accompanying drawing illustrating a diagrammatic view of the complete apparatus, including a *Bosch* high-tension magneto.



Electric Light From High Tension Magnetos.

The one terminal *c'* of the coil is connected to the terminal *d*, which is in connection with the primary winding of the magneto, and is provided for use in conjunction with a switch *g*, whereby the ignition may be cut out by earthing the primary current and preventing an effective portion of it passing through the contact breaker. The other terminal *c''* is connected to one of the terminals of the lamp; the other terminal of which is "earthed" at *f*. A switch *g* may be inserted in the circuit at any convenient place between the coil *c* and earth, whereby the lamp may be put into and out of action.

The inventors have subjected this device to a test with a one and two-cylinder motor-cycle engine, employing a *Bosch* magneto for ignition purposes, using a metallic filament lamp of 3.5 volts. Their experiments have shown that excellent results can be obtained from an iron core having a length of about 4 to 5 inches and a diameter of 5/16 inches, wound with approximately 500 turns of double cotton-covered copper wire No. 24 and efficiently insulated between the windings. The apparatus may be applied to other suitable magnetos in a substantially similar manner.

A POWERFUL ELECTRO-MAGNET FOR BATTERIES.

A great many electrical experimenters often wish to have a good strong electro-magnet suitable for excitation on a few

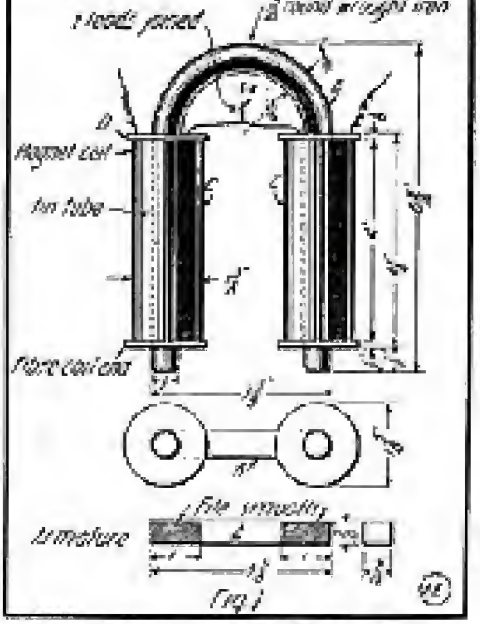


Fig. 5. Parts of Powerful Battery Magnet.

battery cells, such as dry cells, for instance. The following describes the detailed construction of such a magnet. This data is from an instrument that has actually been built and, when operated on 10 ordinary dry cells, such as the "Columbia," it developed a lifting power of 30 pounds, the voltage being 15 and the current in amperes 0.95. This lifting effort was attained by tying the load to the center of the iron armature A.

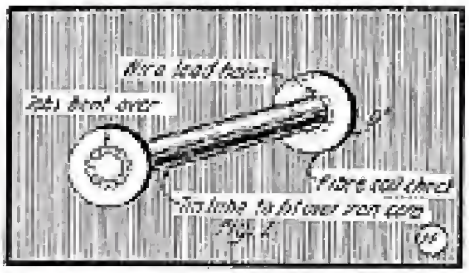


Fig. 1. Making Magnet Coil Spools.

To begin with, a piece of wrought iron bar should be obtained at the hardware store or from a blacksmith, and it should have a diameter of 9-16 inch. Its length should be sufficient to allow of bending to the dimensions shown in the sketch Fig. 1 at B. Another short piece of square wrought iron bar, A, Fig. 1, is required also to form the armature. One side of the armature bar, that which is to be in contact with the pole faces of the magnet, must be filed off smooth and flat for about 1 inch at both ends to insure a good magnetic circuit between these two parts of the iron circuit.

After the piece of 9-16 inch round iron bar has been bent to a "U" shape, as indicated in Fig. 1, the two pole contact faces must be filed up smooth and flat with respect to each other. Also to increase the magnetic density at the pole faces, and thereby gaining a greater pull, these pole face areas are reduced as shown, so that they have but ½ inch diameter. This can be accomplished very easily with a file.

The magnetizing coils are wound on two tin spools or bobbins, made after the fashion illustrated at Fig. 2. The end cheeks of these spools are made of heavy cardboard or fiber. The tin tubes should be about 4½ inches long and fit nicely over the iron core legs. After making the tubes, which can be held together by a little solder, the end cheeks are placed on them and the ends of the tubes (previously cut all way around for about ⅜ inch deep are bent upward to hold the cheeks on. One cheek on each bobbin should have two 1-16

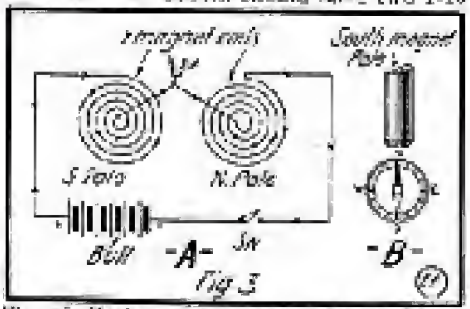


Fig. 3. Hooking Up Magnet Coils for Proper Polarity.

inch holes drilled through them—one near the tube and the other close to the outer edge. These are to lead the coil or wire terminals through.

When the two bobbins have been finished thus far they are insulated over the metal portions by wrapping two layers of ordinary notepaper around them. This paper must fit snugly up against the end cheeks to prevent the coil wires from touching the metallic part of the bobbins, as this would be liable to cause a "ground."

The bobbins are each wound with 14 layers of No. 22 B. & S. single cotton-covered copper magnet wire (this requires about 2¾ pounds of wire). These layers are to be placed on evenly, and not wound on any old way, as fewer turns are obtained on the coils in this way. The starting terminal of the coil is led through the inner hole in the end cheek, while the finishing terminal is brought out through the outer cheek hole previously made for it. The two magnet coils are joined in series at 3A in diagram. In assembling the complete electro-magnet the relative magnetic polarity of the two poles must be observed, and reference to Fig. 3 will make this quite clear.

The poles of a magnet are termed north and south, depending upon whether or not they attract the N or S. pole of a magnetic needle, such as in the small compass shown in Fig 3 at B. By looking at the diagram Fig. 3 A, it is perceived that the current must travel around the two magnetizing coils in opposite directions to give resultant

(Continued on page 308.)

HOW TO BUILD AN ELECTRIC FURNACE FOR LABORATORY USE.

Following is a description of an inexpensive, but practical, experimental electric furnace.

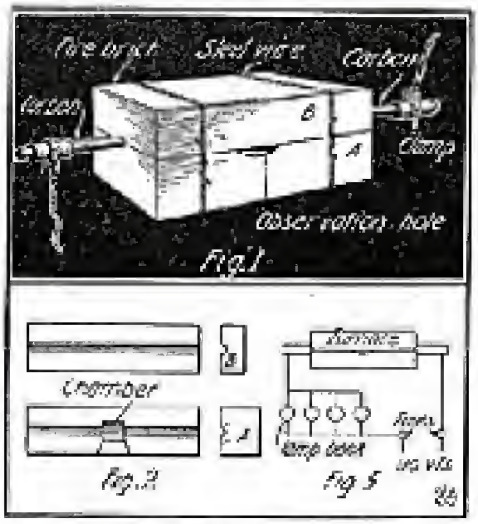
The materials necessary are two fire bricks (such as those used in building fireproof structures), two carbon rods, and two pieces of No. 10 gauge steel wire, about 25 inches long, to be used in holding the fire bricks together.

Grind or file a groove in A and B, as shown in Fig. 2, so that when the bricks are placed in position the carbon rods to be inserted will slide easily back and forth.

On one brick, used for the base of the furnace, chisel a groove in the middle, two inches in diameter, so that it forms a semi-circle (see Fig. 1). This hole will be used in making observations of the reactions that take place and for the insertion and extraction of materials to be melted, which are placed in the grooved chamber between the ends of the carbon rods.

This simple furnace when properly assembled and connected to 110-volt lighting current, as illustrated in Fig. 3, will develop such an intense heat that some of the following refractory substances can be made: Calcium carbide (used for generating acetylene gas), carborundum and artificial gems. The current can be controlled by a lamp bank made up of a number of 110-volt lamps (D. C. is best employed), as indicated in diagram. A water rheostat can also be used for the current regulation.

Contributed by
ALFRED GWYNNE.

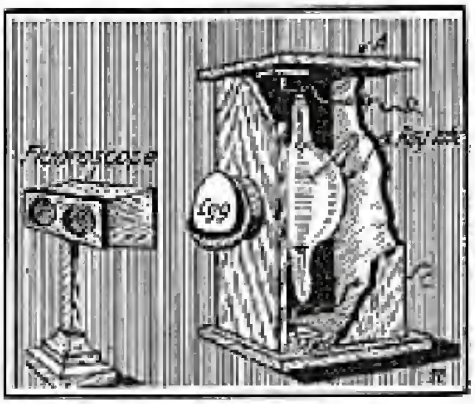


Simple Electric Furnace.

INSPECTING EGGS WITH X-RAYS.

Eggs are now being examined by X-rays, and this new method is said to be a very good one.

A special darkened room is installed in the quarters where the eggs arrive and the apparatus consists of a closed lantern containing an X-ray tube. In the front of the



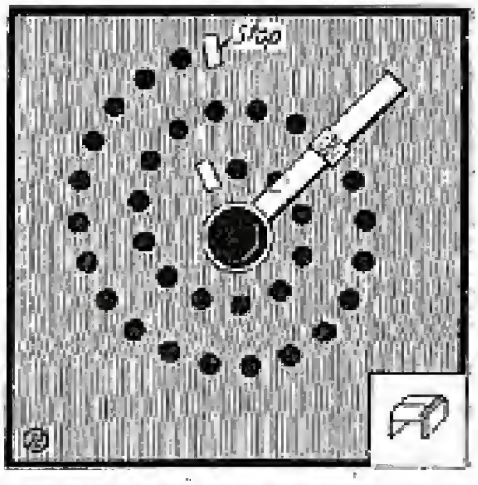
X-Rays Used to Test Eggs.

lantern is a small opening about the size of an egg, so that the rays can pass through the egg. The rays throw a shadow of the egg upon a fluoroscopic screen placed in front. Fresh eggs are seen to be quite clear, but any defects are shown up as spots appearing on the screen. Such eggs are put in the second class, but if the spots are too large they are rejected. It is well to have a sheet lead front in the box A to screen off the rays not necessary in inspecting the egg.

UNIQUE COUPLER SWITCH.

The multi-point switch, shown in sketch herewith, provides a large number of switch points in a small space. This is accomplished by arranging a sliding contact shoe of thin copper or brass, as perceived, and as the switch arm is rotated this movable or sliding contact shoe gradually works outward from the center of the switch, at the same time making contact with each successive switch point, as will be apparent.

A fiber strip may be mounted, as shown, so as to prevent the switch shoe from moving past the final contact points either way. These stops are made level with the tops of the switch points, of course, so that the lever can pass by them, but so as the shoe cannot.



Unique Switch Enables Use of Many Contacts in Small Space.

Contributed by E. L. H.

RADIO DEPARTMENT

Tufts' College Professor Devises New Wireless Control Scheme

A NEW scheme for controlling various kinds of mechanical apparatus by means of wireless waves properly developed and propagated from an antenna has been devised by Prof. H. M. Shepard, of Tufts College. Our illustrations show Prof. Shepard's apparatus as used in demonstrating his new system of radio control. It is said to be different from that involved in the well-known "Hammond" apparatus of this character, and also this new arrangement does not make use of any ground or "earth" connection, as is usual with practically all other systems of this type.

The first illustration shows the inventor holding his transmitting apparatus, which is quite light, as will be evident. This employs a spark similar to other radio systems and the waves are sent out from the vertical metallic antenna rod and the etheric waves set up are intercepted by the vertical antenna of the receiving set, mounted on a table.

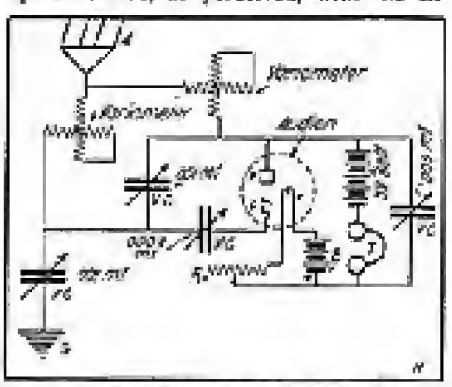
By means of this apparatus it is possible to ring bells, start and stop motors, operate semaphore arms, light lamps, steer a miniature auto, navigate a 7-foot model boat, fire a cannon, etc.

Prof. Shepard is now at work on a wireless submarine boat destroyer. This apparatus, as so far developed, employs no ground connection, as previously mentioned, and in case a torpedo fitted with this device misses its mark, it can be steered back to the sender, in virtue of the wireless wave control involved in its operation.

The second illustration shows Prof. Shepard operating a miniature automobile, and the little girl in same is his young daughter, Miss Leonora Shepard.

A NEW AUDION RECEIVING CIRCUIT.

Herewith is illustrated a new receiving circuit employing two variometers and four variable condensers in connection with an audion detector. With these condensers, having maximum capacity, it was found that best efficiency can be realized. Each variometer, as well as condenser, is independently tuned and a regular audion hook-up is obtained, as perceived, with the exception that across the phones and high-voltage battery a variable, high capacity condenser is shunted. Very sharp tuning is readily accomplished with this new circuit and static is practically eliminated.



Improved Audion Hook-Up With Variometers for Sharp Tuning.

SAYVILLE WIRELESS STATION COMPLETED.

The Sayville wireless station, recently taken over by the United States Government from the Atlantic Communication Co., is now completed and is one of the largest stations in the world. The fourth of the new reinforced towers has just been finished. This makes a total of 11 towers.

The new powerful 100 K.W. transmitter makes direct communication with Germany easy, regular and intelligible.

Above: Prof. Shepard Holding His New Wireless Control Transmitting Set. Receiving Set with Various Devices Mounted on Switchboard.

At Right: Prof. Shepard's Daughter Enjoys a Ride in the New Radio Controlled Automobile. No Ground is Used.

Photo (C) International News Service.

HAMPTON, IA., GETS RADIO TIME.

Hampton will soon be one of the few small cities in Iowa to receive correct time signals by wireless direct from Springfield, Ill., and Arlington, Va. C. H. Haney has had an aerial wire installed extending from the top of the standpipe to the tower of the court house and thence to the roof of the Rule block, and wires will lead from there to an instrument in his store, enabling him to get the time by wireless direct. For the present he will be able to receive messages only, but later an apparatus may be installed enabling him to send out signals also.

The November issue will eclipse even the present one. Don't miss it.

WIRELESS STATION IN CAMP.

A wireless station has been set up by David Meirowitz at S. Melnik's cottage on Orlando avenue, at Pontoosuc Lake. The aerial has only one wire 200 feet long. After some experimenting very good results have been obtained.

A UNIQUE CHEMICAL RADIO AMPLIFIER.

At last an amplifier for the radio amateur, which will boost incoming wireless messages *fifteen hundred times* their original audibility in strength of signals, has been devised.

This new amplifier consists of a special chemical placed between two electrodes which arrangement changes the resistance by virtue of a diaphragm attracted to an electro-magnet. This will be more clearly understood by referring to a cross-section view of this instrument, which is depicted in Fig. 1. It consists of a permanent magnet A, supporting a metallic case N, having a threaded screw cap M. The case contains the amplification parts, comprising the electro-magnet B, which has a small iron core E connected to a very fine steel diaphragm D, carrying a cup F upon its surface. Another cup G is placed on the opposite side and within it, the (secret formula) chemical is placed at I. A tube H is provided so that the material is retained within the cups. The cup G is connected to a threaded rod J and lever K, supported by a rubber standard L on the steel magnet A. The diaphragm D is gold-plated in order that the chemical will not affect the steel. The electro-magnet B is connected by means of the wires O, while diaphragm D is joined to wire P. Rod J connects to terminal Q. The complete amplifier is shown in Fig. 2. The knob at the front is used to regulate the cup G

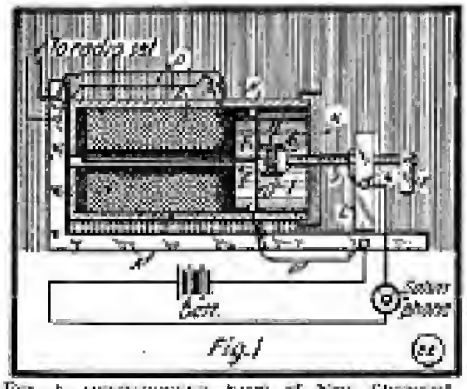


Fig. 1. Diagrammatic View of New Chemical Amplifier.

(Fig. 1) and is used in place of lever K. This is done in order to regulate the pressure on the chemical mixture between the cup electrodes.

The action of this amplifier is somewhat microphonic, and as the diaphragm is caused to vibrate by the incoming signals it varies the distance between the electrodes, consequently varying the resistance of the chemical and thus also the phone circuit. A 5 ohm 'phone is used in connection with this apparatus, so it is perceived that a large current is used in this secondary circuit. A horn is usually fitted to the receiver so that messages can be readily heard around the room without using a pair of head 'phones. If two or more of these units are used in tandem signals can be boosted to such an audibility that one cannot stay in the room on account of the terrific loudness of the signals. These amplifiers are also used in long distance telephone work and also for detective work on account of the remarkable sensitiveness.

L. Bishop, the inventor of this wonderful instrument, has spent four long years experimenting on different types of amplifiers and has found after more than a thousand different experiments that the chemical amplifier of this type gives the best results. Fig. 2 depicts the interior of the amplifier, while Fig. 3 illustrates the complete apparatus in cabinet.

Receiving Wireless Messages With Odd Aerials

THE composite illustration shown on the opposite page indicates a number of odd aerials, which may be used more or less successfully under certain conditions for the reception of wireless messages, especially in large cities. The action of these freak aerials is based, of course, upon the fact that they are of metal, and that also they have a distinct electrical capacity and inductance, the same as any regular antennae used especially for the purpose.

The first scheme, shown in Fig. 1, has recently been tried out by a radio experimenter quite successfully, and involves the use of the metal frame and strings of a *Piano* for receiving wireless messages. It may be said that in most of these cases a Ground connection is invariably used, the same as with a regular wireless, and the ground wire may be connected to a gas, water or steam pipe in the building. Failing this, an artificial ground may be provided by driving a piece of pipe several feet into damp earth. Also, the ground wire may connect to a metal plate immersed in a brook, etc.

Of late there has been a great deal heard regarding the use of *Spiral Aerials* where space is at a premium, and Fig. 2 shows such a structure. These are said to work over quite long distances indeed and a great many turns of copper wire are thus provided, which give the entire aerial considerable inductance value, as will be appreciated. The turns of wire can be quite close, even ½ inch apart, the diameter of the coils being 1½ to 2 feet or even more.

Iron *Fire Escapes* on buildings have been used successfully in picking up wireless signals, especially in cities, as seen in Fig. 3.

Another freak aerial, which generally works quite well unless the leader pipes are grounded through iron water pipe conductors, is that shown at Fig. 4, making use of a *Tin Roof* on a house.

A scheme described in detail in the March, 1914, issue of this magazine is indicated at Fig. 5, for the reception of wireless messages, and which employs a *Cardboard Tube* wound closely with a layer of fine insulated magnet wire. This method was tried out by a French engineer, P. Dosne, with considerable success in receiving wireless time signals as sent out by the Eiffel Tower Station at Paris, France. In this case the 'phones are shunted across the detector and the detector in turn is joined in series with a fixed or variable condenser and the inductance coil aforementioned. In this case no ground whatsoever is used. The coil is about 20 inches long; its diameter is 2 inches.

At Fig. 6 is depicted a method which was tried out by Major G. O. Squier, of the U. S. Signal Corps, some years ago quite successfully for short range work. As observed, two large *Iron Nails* are driven into a *Tree* of fair height; one nail is driven in the trunk of the tree *near the ground*, while the second nail is driven in the trunk *just below the foliage*. A tuning coil may be used in series with the 'phone and detector, as the diagram shows, although the coil is not absolutely necessary.

Some experimenters have had quite good success utilizing *Wire Fences* as antennae. A gentleman located on Long Island and at a considerable distance from the Sayville radio station succeeded in picking up the signals from that station very nicely indeed.

At Fig. 8 is shown an idea which is often adaptable to some experimenters' surroundings, and this considers the use of the *steel Elevator Hoisting Cable* as an antenna. A peculiar feature about this scheme is that as the elevator goes up the wave length becomes less and thus, if the elevator is doing service pretty regularly, there is provided an automatic tuning system for the lucky experimenter making use of this make-shift aerial. If he should happen to use this scheme in such a building as the 60-story Woolworth skyscraper in New York City he would have indeed quite a range of wave lengths automatically tuned in and out several times a minute!

A scheme which has been tried out by H. Gernsback some years ago with considerable success in New York City consisted of pasting or temporarily pinning *Tin-foil Strips* on the wall of the room, as Fig. 9 portrays. Needless to say, all of the foil strips are overlapped or pinned together so as to make the whole act as a single capacity area. In these experiments he used some 50 square feet of tin-foil.

Another substitute for the regular antennae is a *metal ceiling*, as pictured in Fig. 10.

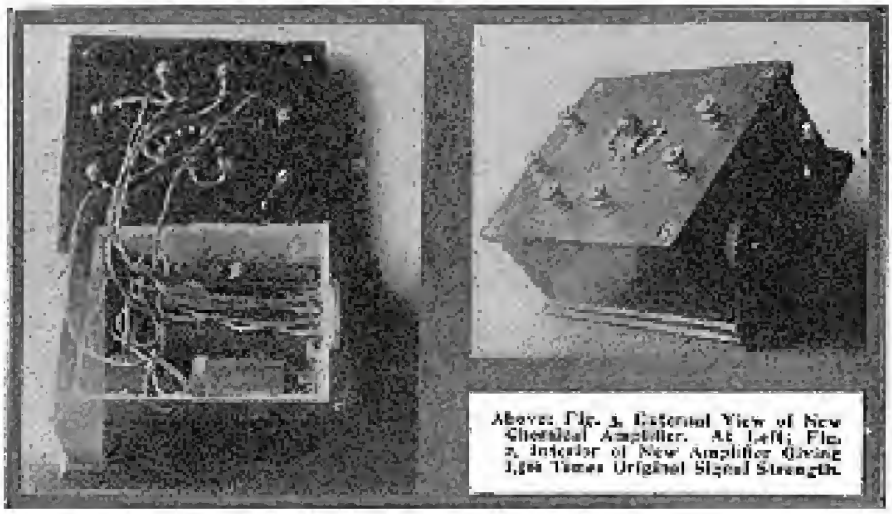
The scheme at Fig. 11 utilizes a *Metal Bed*, such as a brass or iron structure, for an antenna.

Even *Umbrellas* with their metal ribs will serve for the reception of wireless signals, as Fig. 12 indicates.

In all the diagrams here outlined a 1,000-ohm 'phone is preferably used, or better yet, a pair of them, together with a sensitive mineral detector using galena or silicon, which requires no battery.

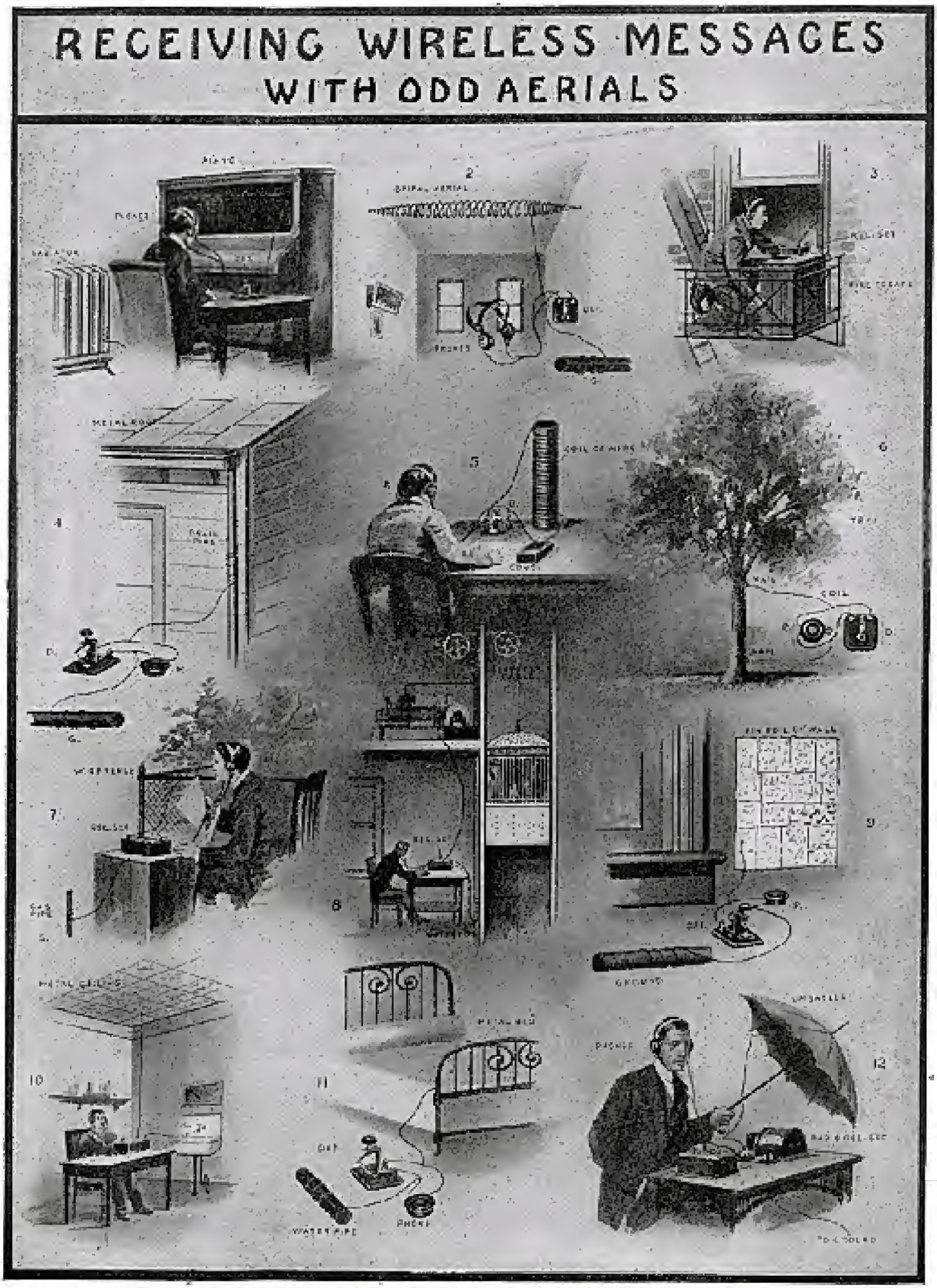
It goes without saying that where these

(Continued on page 298.)



Above: Fig. 3, External View of New Chemical Amplifier. At Left; Fig. 2, Interior of New Amplifier Giving 1,500 Times Original Signal Strength.

RECEIVING WIRELESS MESSAGES WITH ODD AERIALS



Full Explanatory Text on Opposite Page.

Telemechanics or Control by Radio Waves

THE science of controlling distant machines or devices, such as boats, sleighs, or torpedoes, has been brought into the public eye very prominently in the past few years by the successful researches of John Hays Hammond, Jr., and several European scientists. The possibilities and usefulness of "telemechanics," as this branch of wireless science is termed, is of great importance in time of war. How do we know that some of the war vessels reported as blown up in the present war by mines were not blasted into eternity by a ship-borne torpedo guided by invisible etheric waves?

Fig. 1. A "Gabet" Radio Controlled Torpedo in the River Seine, France.

Some six years ago the French tried out a successful wireless torpedo controlled from shore by a radio sending station. A view of one of these dreams of war gliding swiftly through the waters of the River Seine is shown in the photograph, Fig. 1. This particular torpedo carries antenna structures above the water, as perceived, and was perfected by M. Gabet.

A most interesting phase of this subject is how can it be done without the etheric waves from various radiotelegraphic stations interfering with it, causing it to become erratic in its behavior or changing its course? It may be said that some of the finer developments of the art of telemechanics are pretty well locked up in laboratory note books as yet, but, however, a few methods of interest to those interested in such work are cited here.

In the diagram, Fig. 2, is outlined the plan for rigging up a small model boat with propelling motors, batteries, wireless control devices, aerial, etc. The boat may be made of tin or galvanized sheet iron, soldering all the joints. Details are not mentioned on the design of the boat, as most readers would probably prefer to make or use a stock form procurable cheaply from most toy stores.

Let us now take up the scheme of radio wave control applicable to such an experimental model. One of the simplest means, theoretically (and also practically if the proper apparatus is used), such as a quenched spark transmitter, etc., is shown in the diagram, Fig. 3. The basis of this whole scheme now under discussion is the accurate transmission and reception of sharply tuned waves having different lengths or vibration periods.

The arrangement is not complicated, although it may appear so at first sight. At the sending station an aerial A_1 is connected to a variable tuning coil B. It is supposed that several wave lengths or tunes are obtainable in this way, each wave being several hundred meters, if necessary, different in value from the next nearest wave. For instance, suppose the six steps shown vary from each other by a difference of 200 meters. If the switch lever D on step 6 gave a wave length of 400 meters, then step 5 would give 600 meters, etc. As the wave is changed in the aerial circuit A-B-G the closed oscillating circuit C-O-D is simultaneously varied in proportion so that both open and closed oscillating circuits are in syntony or tune.

If a good quenched spark transmitter is employed the tuning will be very sharp, as we well know. The transmitter may be a spark coil, but preferably a small transformer working on 120 or more cycles frequency A.C. A Clapp-Eastham "tip-tone" set will create sharp tuning facilities on 60 cycles.

So much for the emitting of the successive tunes or waves. At the receiving station on the model boat or other device several attuned circuits are provided. Each properly tuned receiving circuit contains a coherer C_5, C_6, C_7 and C_8. Each coherer actuates its own relay R_5, R_6, etc. The relays in turn control their respective local circuits through batteries B_5, B_6, motor A_6, motor B, etc. All batteries can be of the flashlight type.

Every coherer circuit is properly attuned to the various emitted wave lengths by means of tuning coils L_5, L_6, L_7, etc. These inductances may be shunted by variable condensers to more sharply tune the circuits. Also the coils are best made adjustable. A common antenna A serves all the resonant circuits, as well as a common ground G, which can be the metallic hull of the boat.

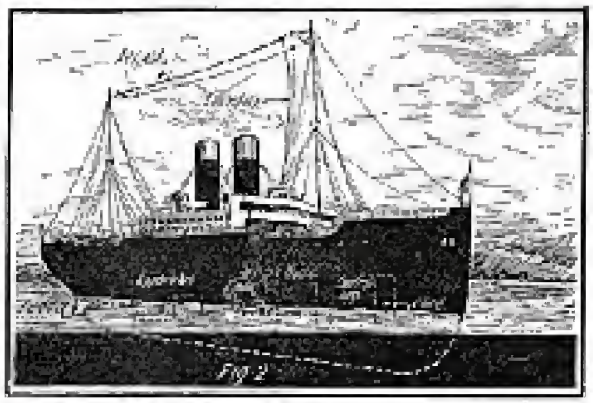


Fig. 2. Miniature Boat With Radio Control Set on Same.

To simplify matters permanent magnet field motors are utilized at A_6 and B, which motors, if on a boat, may control, say, the rudder and propeller. To cut off the motor current from A_6 or B two extra tuned circuits with coherers and relays are necessary, but are not shown for the sake of clearness. As the various waves of differing lengths are sent out from the transmitter the corresponding coherer and relay circuits respond actuating their respective motor circuits.

Two sets of batteries are used to control one motor of the type mentioned, and by passing the battery current into the motors in opposite directions alternately by the relays R, and R_6, for example, the motor is caused to rotate right or left handed, as the case may be.

This is only one idea for radio control and many others have been worked out. One of the simplest, but disadvantageous in that prompt selective control is not possible can be had by utilizing the old step-by-step relay with a ratchet wheel and pawl. A solenoid or plunger type electro-magnet acts on a pawl tooth, as seen in Fig. 4, serving to pull the drum and switch lever S around step by step over the various circuit contact buttons, 1-2-3, etc. The contacts are usually arranged in a circle.

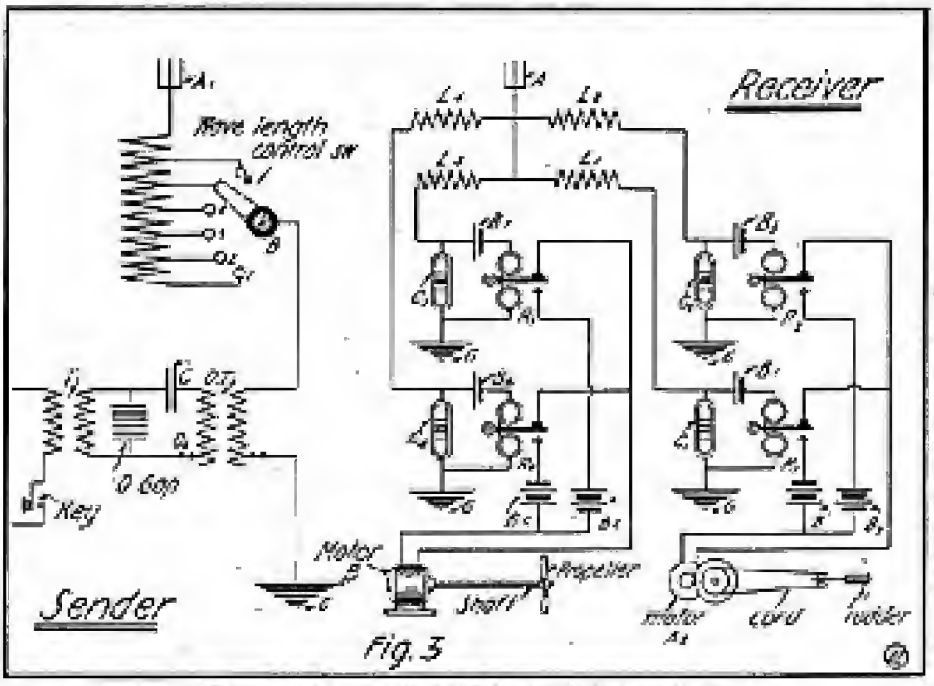


Fig. 3. Control Circuits for Wireless "Telemechanics."

A very unique scheme said to be practical is illustrated in the diagram, Fig. 4. Here the selenium cell is brought into play, which, as is well known, changes its electrical resistance in direct proportion to the strength or amount of light thrown on it. In this manner a relay is operated with a selenium cell and battery in series. If the relay be adjusted so it does not close its local circuit with the selenium cell in the

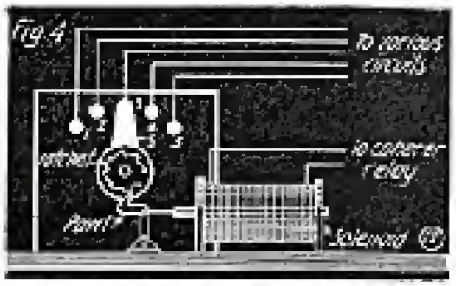


Fig. 4. "Step by Step" Radio Control Relay.

dark, then, when the cell is exposed to light, its resistance falls from 1/4 to 1/6 or more of its dark resistance, and the relay deriving more current from the battery will close.

The complete theory of Fig. 4, however, goes further than this and takes into consideration the latest discoveries in the art, which made known the fact that under certain physical conditions selenium will perform its function best as above explained when a certain *colored light*, corresponding to a definite etheric vibration frequency, is projected against it. With this in mind, a working arrangement possible is hypothesized at Fig. 5, where a powerful searchlight A is caused to project various colored beams of light on to the parabolic reflector R.F., in the focus of this reflector are grouped the battery of selenium cells 1-2-3-4, etc. Each cell operates a distinct relay, as did the coherers in Fig. 3. If a red light is thrown on the selenium cell, then a "red-sensitive" cell responds, causing the device carrying it to act accordingly.

This new science is undoubtedly only in its infancy, and at the toddling age at that, so that the wireless fiend will find plenty

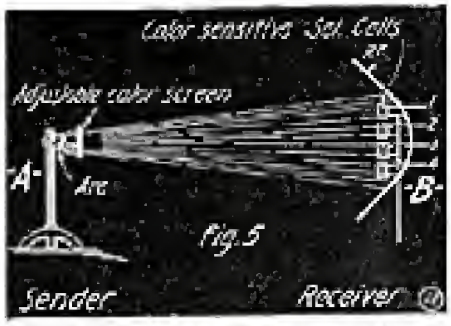


Fig. 5. Using the Selenium Cell for Wireless Control.

to keep him busy in this useful branch of the wireless art.

MEMBERS OF RADIO CLUB TO PREPARE FOR COMMERCIAL LICENSES.

A course of lectures and instruction will be given to the members of the Connecticut Valley Radio Club beginning with its next meeting, and after finishing the course the members are expected to be prepared to take the examinations in Boston for first-grade commercial licenses. The future meetings, which will begin the season in wireless telegraphy, will be featured by wireless telegraphy apparatus loaned by the various manufacturers.

Efficiency in the Amateur Radio Station

By Thomas W. Benson

EFFICIENCY in wireless telegraphy resolves itself in getting the longest range and the loudest signal obtainable with the apparatus in use. Of course good design is necessary, but the object of these paragraphs is to point out the best methods of utilizing instruments that are really unfitted for radio work.

For instance, take the amateur who possesses an X-Ray coil. It gives a long thin spark, ideal for the purpose for which it was designed, but in the average set its efficiency is very low, due to the fact that most articles describing the use of coils for radio telegraphy take it for granted that the proper coil is employed, and deal with the standard apparatus in connection with it.

A coil of this description when connected, as shown in the usual hook-ups, gives a long wave or else a highly damped wave. The first is the result of the enormous amount of capacity used to shorten up the spark gap. A short gap is necessary if the decrement is to be kept low, as the spark gap is a form of resistance which affects the decrement. On the other hand,

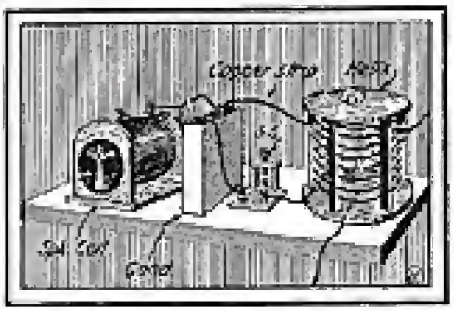


Fig. 2-A. Compact Arrangement of Wireless Sending Set on Shelf.

if a small condenser is used to keep within the 200-meter limit, an extra long gap is necessary and a broad, highly damped wave is emitted. The latter evil is the less noticeable because the Government stations will pick up and observe a long wave, paying little or no attention to the badly tuned wave if under 200 meters.

The proper method of employing an X-Ray coil for wireless telegraphy is sketched in Fig. 1. Here the coil is used without condensers, the aerial itself acting as the capacity, while a lumped inductance, I, is connected in the aerial lead. The gap used is of the compressed air type where the spark occurs in air at a pressure of two or three atmospheres. The exact design of the gap is left to the reader, but one that can be easily constructed is shown.

The container is an ordinary Mason fruit jar, one-quart capacity. The standards are mounted on a piece of hard rubber and the pressure is created by a hand bulb acting through a check valve. Soft rubber gaskets are used to render the whole air-tight.

This method gives a sharp wave of good carrying power and with a very small gap it may be used with coils under one-inch spark length, whereas the helix cannot be employed very well.

Another point overlooked in amateur wireless stations is the relation between interrupter speed and the high tension condenser. The usual practise in determining the proper condenser is to build one with as many plates as the constructor happens to have. If this condenser stands the discharge of a two-inch coil, it is a two-inch coil condenser. If someone else finds that a three-inch coil does not puncture it, it then becomes a three-inch coil condenser, and so on indefinitely.

It is also true that from time to time

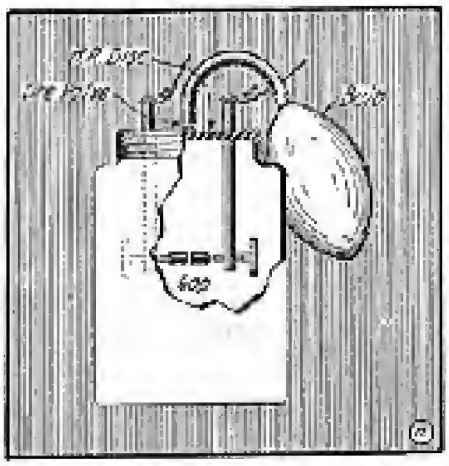


Fig. 1. Home-made Compressed Air Spark Gap.

tables appear in the various journals, stating the number of plates to use with the different size coils. These tables are very good, invaluable in fact when followed out properly, but many amateurs make a serious mistake in trying to obtain a very high pitch note with these condensers. They have, in most cases, speeded their interrupters up to the limit; when, of course, these condensers have been adapted for use with a medium speed interrupter. Therefore, it is necessary to adjust the voltage and speed of the interrupter for best results or efficiency.

I will not deal with spark gaps here, as they have been well covered in the past, but one thing necessary is to keep them cool by radiating wings, air blast or damp-

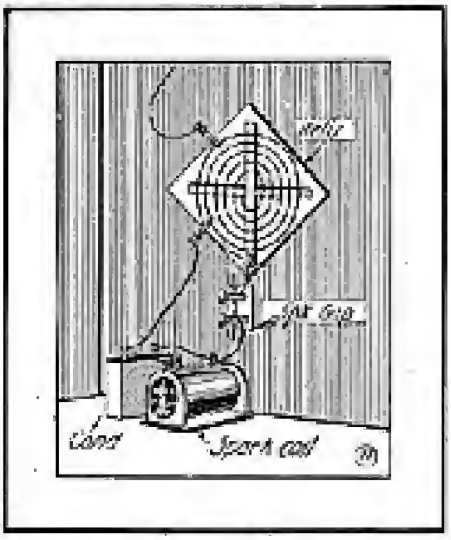


Fig. 2-B. Short Wiring Possible for Radio Set on Table and Wall.

ened sponges, and let me suggest that a vertical gap be used instead of a horizontal in straight gap sets. In rotary and quenched gaps this is not so important.

I have also noticed a number of articles on synchronized rotaries to be used with spark coils. A much better way is to use the interrupter end of the device and use a quenched gap instead of the rotary. Less noise and more satisfactory results are obtained. Efficiency again!

By all means keep the leads as short as

possible, both on the sending and receiving sets. Arrange the instruments in proper order. If your sending set is on a shelf, Fig. 2, "A" offers a suggestion for short wiring; if on a table and the gap and coils are fastened to the wall, the second sketch, "B," will be found of service. Use copper

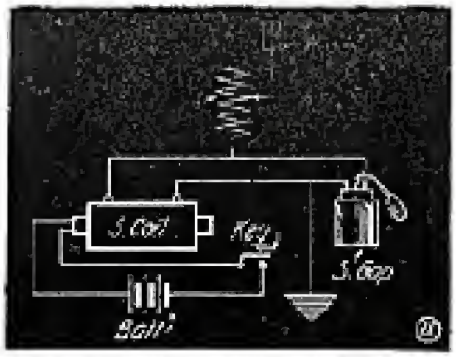


Fig. 1. Connections for Compressed Air Spark Gap.

strip for the sending set connections, not "bell wire"!

The aerial switch is another energy-wasting device. It puzzles me why amateurs persist in using a switch, which requires the best of insulation and is always more or less bulky, when a small switch properly connected is much better, or even a telephone key may be used. In Fig. 3 a hook-up is shown that has the usual aerial switch beat for several reasons. The first is that leakage does not affect the results, thus making it cheaper and easier to construct. Secondly, it enables a symmetrical wiring diagram to be used. The aerial enters at top of window, runs to coils, thence to switch and thus to ground. An easier, better method is impossible. The hook-up, using a telephone key, is also added. This may be mounted on a table and the change over can be made in an instant with the small finger. Who wants to use those big switches now?

Turning to the receiving set, most losses are incurred in dead ends, poor contacts, detectors and *poor* condensers.

To overcome dead ends, use fixed inductances and use variables for tuning. The primary of the coupler should have about 40 turns of No. 24 S.C.C. copper

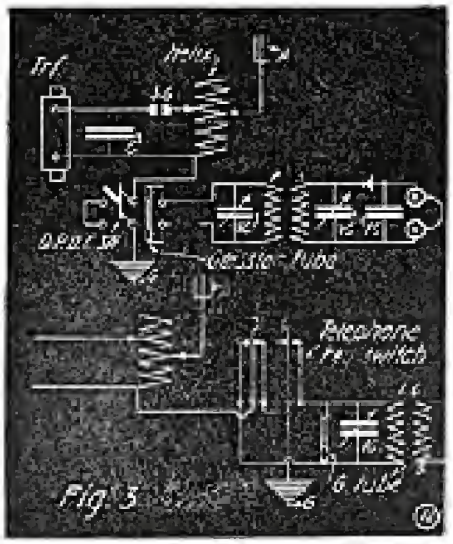


Fig. 3. Simplified Transmitting and Receiving Radio Hook-ups.

wire and the secondary 60 turns of No. 28 S.C.C. The tubes may be 4 inches and 3½ inches in diameter, respectively. The variables, of a good commercial make, as compared with home-made variables (which are nothing more than make-shifts nine times out of ten), should be connected in parallel with the windings. Wave lengths up to 300 meters may be tuned in this coupler; the exact length depending, of course, on the length of the aerial. To receive longer waves a second coupler should be constructed, using 200 to 250 turns on the primary and secondary, respectively. A switch is arranged so as to throw from one coupler to the other, and the fear of "dead ends" is removed. The above construction does away with sliders and switches, thus lessening chances of poor contacts.

The detector is a trouble maker and many devices have been produced to obliterate this. Galena is the favorite and a stand for this excellent detector should be selected that is sturdy, simple and provided with fine adjustments.

All condensers should have an air dielectric, even the blocking condenser. A good blocking condenser may be made from 70 sheets of aluminum, 4x6 inches, mounted in a case and separated from each other by strips of mica at each end. This condenser should be adjustable by a suitable switch. This is another factor for obtaining loud signals, which is often overlooked, as nearly every set of receivers requires a different capacity. The reason for this has puzzled many, but still the fact remains. However, it may be more clearly understood when the 'phones and blocking condenser are considered as an oscillatory circuit tuned to a certain harmonic of the secondary circuit. As a general rule, the higher the resistance the smaller can be the blocking condenser capacity.

In closing, I would say, run parallel wires as far apart as possible; cross all wires at right angles and solder each and every joint.

An Almost Human Wireless Receiving Set

An automatic receiving outfit, an "almost human radio receptor," was the title given to his latest device by Mr. Walter Goodchild, the well-known inventor of the "Permanent Wireless Detector" and other scientific apparatus.

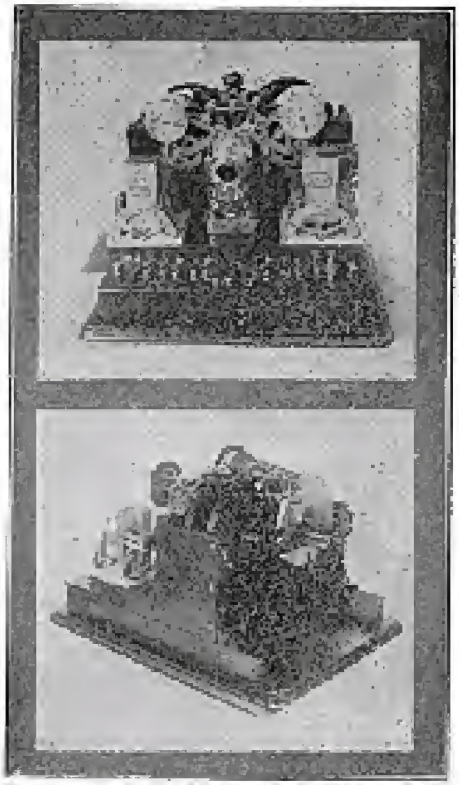
This receiving set is operated entirely by an electric motor, as depicted in the center of the illustration at Fig. 1. This motor operates the various mechanisms by pressing any of the control "keys," purposely on the front panel, each of which performs a certain distinct function.

The complete machine comprises a specially designed inductive coupler, which consists of four reels containing a copper ribbon, one side of which is coated with a special flexible insulating compound. These reels are wound and unwound as required by the motor. Two sets of coils, one pair of primaries and one pair of secondaries, are provided, as Fig 2 shows. The inductive value between the primary and secondary is changed by moving the secondary back and forth parallel with the primary: this is accomplished by the same motor, operated by a different key. A scale and needle indicates this inductive value, as seen in the upper part of the instrument at Fig. 1. The dial indicator moves according to the position of the secondary coils. The dials on each side of the machine denote the *exact lengths in meters*, corresponding to the position and amount of ribbon in use on the coils.

Two specially designed variable condensers, placed on each side of the apparatus, are illustrated in Fig. 1. These are driven by two separate electric motors, also operated by control "keys" located on the right hand corner of the instrument. The condensers are of the variable plate type, i. e., instead of varying the dielectric as in the ordinary variable condenser; the number of plates in use are actually connected and disconnected electrically by changing the position of the plates. This is accomplished by the motors and in this way the condensers are absolute and reliable in their work. Here the proper dials depict the *capacity of the condensers* in the regular units.

The detector is of the permanent type and is located inside of the case, as also the batteries for driving the motors. The central switch is used to vary the current supplied to the detector.

The operation of this remarkable set is very simple, requiring merely a pressure on the right "key," and watching at the same time the dial indicators to see that the proper wave length is tuned for. It has been found in testing it out that it takes only 11 seconds to change the wave lengths from 300 to 8,000 meters. The set can easily be carried about, as it is very compactly built, adapting it for use on aeroplanes, battleships, automobiles, etc., as the keyboard can be located in any place desired.



Front and Back Views of Improved Radio Receiving Set That is Almost Human in Its Workings. Fig. 1. Above; Fig. 2. Below.

WIRELESS SAVED GERMANY MANY MILLIONS.

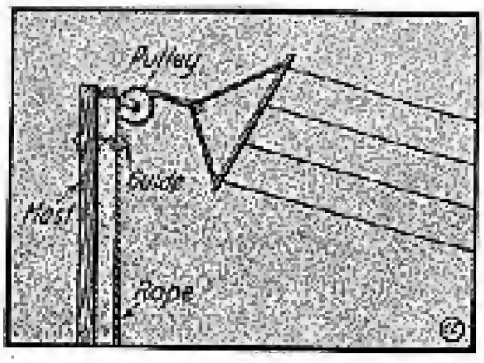
"War has been declared on England. Make as quickly as you can for a neutral port."

This message, flashed for a radius of 2,000 miles over the system of world-girdling German wireless telegraph stations at 5 p. m. on Aug. 4, 1914, saved Germany the bulk of her merchant marine, according to Godfrey Isaacs managing director of Marconi's Wireless Telegraph Co., London, England, at a meeting of the company.

The sinking of the Hamburg-American liner "Vaterland" alone, he added, more than balanced the $10,000,000 Germany had expended in erecting the stations.

GUIDE FOR AERIAL ROPES.

A simple but efficient rope guide for an aerial pulley may be made from a ¼-inch bolt about 6 inches long and a couple of nuts. The bolt is bent, after the head has been cut off, in a circle to fit the rope. A hole is then bored into the aerial mast to



Guide for Aerial Ropes to Prevent Jumping Off Pulley.

fit the bolt, and a nut is put on each side of the mast. The guide should be placed about 3 or 4 inches below the pulley. This simple device often saves much trouble when the rope catches in the pulley. Contributed by W. R. MILNER.

LOOSENING CORRODED BATTERY TERMINALS.

It is sometimes very hard to loosen the terminal nuts on storage batteries. This is often true when no great care has been taken to see that the terminals were free from the acid used in the battery before the terminal nut was screwed on. In cases where these nuts "stick" it should be remembered that if too much force is used the terminal is likely to be torn off bodily.

The best method that I have found to remove them is to use a pair of pliers which have been made fairly hot and to hold the terminal nut with them until the terminal parts are heated through. The nut will then turn quite easily. It is well to cover the screw threads of the terminal with vaseline, after cleaning them thoroughly from acid, before the nut is applied. If this is done there should be little trouble from corroding.

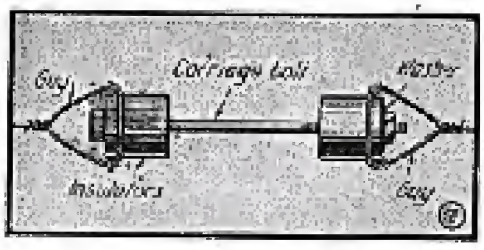
Contributed by

MILTON E. SAUL.

[Soaking the terminals in strong ammonia for 30 minutes accomplishes the same purpose.—*Editor.*]

AN INSULATED TURNBUCKLE.

Here is an easy way of combining the insulator and turnbuckle on the guys of a wireless pole into one piece, thus strengthening the guys by not breaking them up into several parts to insert insulators and turnbuckles.



Insulated Turnbuckle.

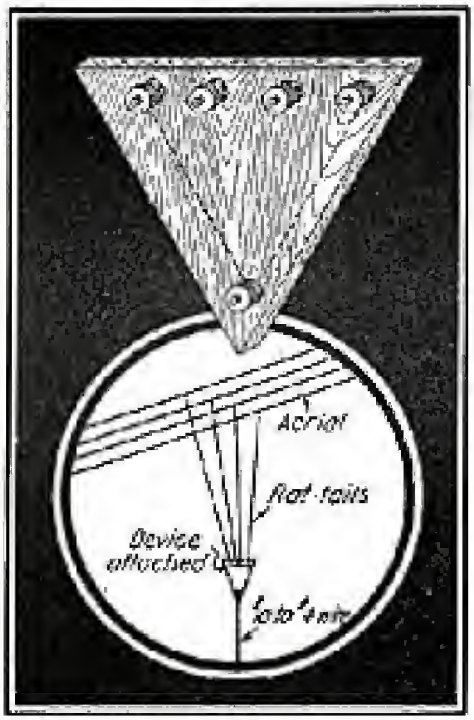
The insulated turnbuckle herewith described consists of three parts, namely, the turnbuckle, which in this case is an ordinary ¾-inch carriage bolt having a diameter of ¼ of an inch, and two standard porcelain insulators. They should be arranged as shown in diagram. To tighten the guys it is only necessary to tighten the end nut of the bolt.

AN EFFICIENT AERIAL CONNECTOR.

Many wireless troubles result from loose, weak or faulty connections, and the device described and depicted herewith practically eliminates all troubles arising therefrom.

It consists of a simple block of hard wood, shaped somewhat like a triangle, as shown in sketch 1. It should be boiled in wax. Four holes are bored at the top of the block to admit four binding posts from "dead" dry cells. Another hole is drilled at the bottom, where the two sides of the block meet, for the same purpose. Insert loosely all the posts and then take some No. 14 aerial wire and lead around all the posts, arranging as per dotted lines, from one to the other. Small grooves may be made on the back of the block and wire squeezed snugly into these. Tighten the nuts on the posts and fasten the rat-tails and lead-in to posts.

The illustration clearly shows the device attached, but it may be stated that all such "connectors" usually extend down from about 15 to 25 feet from aerial. Lead-in



Antenna Connector Made of Wood.

can be made of from No. 10 to No. 4 wire. Contributed by WILLIE WOTON.

SOME PRACTICAL HINTS.

A short permanent horseshoe magnet fastened to the end of a stick is a most handy article for locating and recovering small screws dropped to the floor from the work-bench. You do not have to get off your seat and get down on all fours to hunt for them. Slide the magnet slowly over parts of the floor and soon the screw will be found attached. *(Provided it ain't a brass one!—Ed.)*

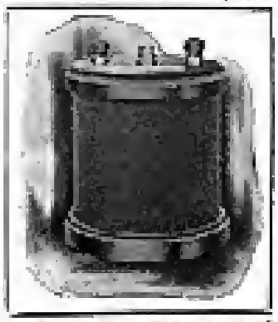
Plain newspaper rolled into a small tube makes a cheap and handy brush for applying lacquers, etc., and also saves the trouble encountered when you failed to clean the brush last time and wish to use it again.

Often it is desired to know if an arc lamp is being fed by A. C. or D. C. A sure and quick test can be made by taking a hexagonal pencil and holding it at one end, and slowly pass it horizontally from side to side before your eyes. If A. C., the pencil seems to rapidly revolve in the hand; if D. C., it appears to be at rest in the hand. Contributed by

GUY H. DALTON.

NEW BUZZER TEST RESONATOR COIL.

A new and effective buzzer test circuit intensifier, in the form of a specially wound inductance, has recently been perfected and placed on the market. The illustration depicts the appearance of the resonator coil, and it is claimed that adjusting radio detectors becomes a pleasure with this resonator, when connected in series with the buzzer test circuit wire.



Presumably the device acts to increase inductive in the circuit, and as the buzzer test currents are a series of rapidly oscillating or interrupted currents it is evident how this inductance in the circuit can "boost" these currents so as to give a magnified effect when they reach the detector and phones.

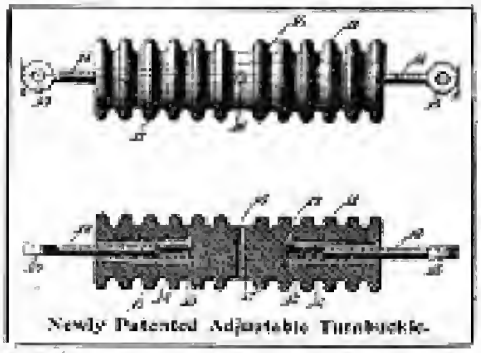
It is said to be particularly efficacious when utilized in conjunction with the well-known Crystalol detector. It is finished in hard rubber composition and is a neat addition to any radio receiving set.

NEW TURNBUCKLE INSULATOR.

A useful form of strain insulator has been patented, and description follows:

The device as completed forms a turnbuckle having a body or shank of insulating material 10, and having threaded eye bolts engaging threaded bolt-receiving members 12 imbedded in the ends thereof, and these bolt-receiving members are in turn firmly anchored in the insulating body so that the device will possess great mechanical strength. Its insulating value is also very high, since the terminals are separated by the body of the insulating material in which they are imbedded.

The device can be adjusted to tighten or loosen the wire or cable in which it is inserted by rotating the body or shank 10. This can be done by inserting a tool such as a rod or screwdriver into the central hole 16 so that a great leverage may be obtained. This central hole is lined with a metallic sleeve so that abrasion of the brittle insulating material will be prevented, since the tool engages and transmits the force through the sleeve 16, which is imbedded in the insulating body. The sleeve 16 is positioned between the ends of the sleeves 12, and is therefore insulated from both of these sleeves and from the eye bolts and the wire in which the device



Newly Patented Adjustable Turnbuckle.

is inserted; the device may therefore be adjusted to tighten or loosen the wire without danger of shock even if one of the eye bolts is connected to a high-tension wire.

THE "BRODIE" DETECTOR.

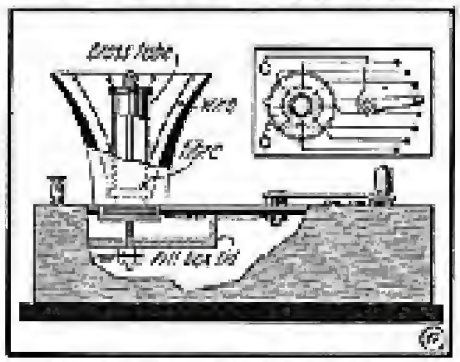
The subject of detectors has been well covered in the past by this magazine, but I believe the one herewith described deserves a place on the list. I have nicknamed it the "Brodie" detector, as the element of chance is foremost in adjusting it.

The principal part consists of a microphone mouthpiece with 10 saw-slots one-eighth of an inch deep, spaced equidistantly around its edge. A small wooden box, 5x8x1 inches, forms a very good base for it. In addition you will need the following: 10 switch points; 1 switch lever; 2 binding posts; 1 threaded brass rod 3½ inches long, and 2 nuts for same; one ¾-inch inside diameter brass tube, 1 inch long; 1 fiber washer, ¾-inch diameter; 1 lid of wooden pill box about 1½ inches diameter; 10 pieces soft brass wire about No. 21.

The mouthpiece (after the slots are cut) should have the perforations in the center knocked out, but the outer row of holes should be left intact.

Take the brass wire, tie a knot on one end, put each wire in a slot with the knotted end outside and run the wire down the inside of the mouthpiece and through out of the holes of the perforated shield at back.

After putting all the wires in place, lay it aside. Now take the box and cut a hole one inch from one end to allow the thread



Multiple Contact "Brodie" Detector.

on the mouthpiece to fit in without slipping through. At the other end lay out and drill holes for a ten point switch as shown in illustration. Drill holes for binding posts at back. After staining woodwork to suit taste of builder, we can assemble the various parts.

The drawing will be of great assistance in assembling, therefore it should be closely studied. Place the transmitter mouthpiece in place in the hole and carefully separate wires inside of the box. Take the pill box, which has a hole drilled through the center large enough to pass the threaded rod. Put rod through it with nut on end, pass up through center of mouthpiece, drop fiber washer over rod, then the brass tube, a washer and finally the other nut. Center the tube and screw up tight after drawing the brass wires taut. Connect each wire to a contact on the switch, threading a bead of paper or thin fiber between them, so they don't touch.

After connecting one binding post to the center brass tube and the other to the switch lever, the detector is ready for use.

To use, break the galena up into pieces about as large as a pea and drop into mouthpiece around center tube. The switch is quickly moved from point to point until an adjustment is found.

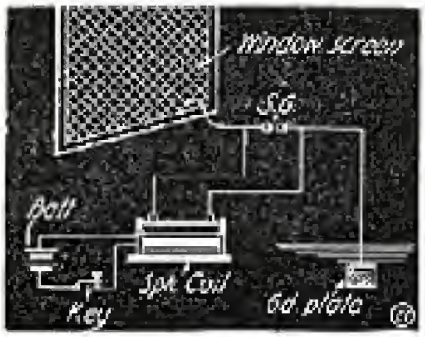
Although there is no law of physics that states that a sensitive spot will be found, it is surprising to get at least two points to respond on the first trial, if the mineral is at all good.

With the assistance of the drawing I believe the description sufficiently clear to allow of the amateur building this instrument, which will always be ready in a pinch. Contributed by

THOMAS W. BENSON.

WINDOW SCREEN SERVES AS ANTENNA.

While my regular antenna was down



Window Screen Radio Antenna.

temporarily I experimented with various substitutes.

Upon connecting my receiving set to an ordinary window screen I found that signals from a local spark-coil station about one-quarter mile away were received almost as loud as on my regular aerial. A small transmitting set consisting of an "Electro" ½-inch Bulldog spark-coil, gap and key was then hooked up with this novel antenna, and, with the addition of an aerial switch, regular communication was carried on. Slightly better results were obtained by connecting two screens together. Neither station was grounded on water pipes, but to metal plates buried in the ground at each station, so that there was no metallic connection between the two stations. The screen used was of ordinary size and not more than 12 or 15 feet above ground.

When using a sending set with an aerial of this kind it is absolutely necessary that all connections between coil, gap and screen be as short as possible and fairly heavy in order to secure good results.

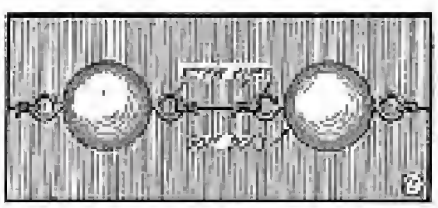
Contributed by

DONALD PALMETER.

GOLF-BALL AERIAL INSULATORS.

A very good aerial insulator may be made from a golf ball, the solid gutta percha kind being the best.

First, it may be well to remove the paint, because it acts like a conductor, due to the lead in the paint; it may be done by applying a coat of paint remover. This accomplished, take a small drill and at opposite ends drill holes a short way in. Now take a few brass screweyes and



Golf Balls Prove Good for Insulators.

thread them in the holes made, being careful that they do not touch at the center. By following the drawing, all points will be made clear. These insulators will be found to be very strong and also will resist fairly high voltages. Several may be joined in series to increase the insulation value. Contributed by

F. PELTON.

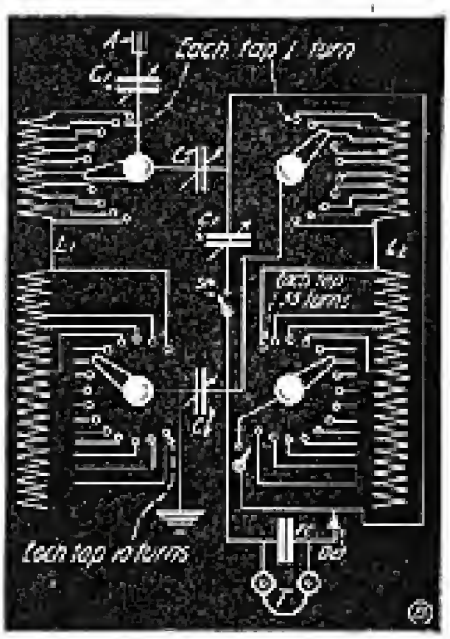
LONG ISLAND BOYS STUDY WIRELESS.

The establishment of the wireless plant in Sayville has given an impetus to the study of the wireless among Sayville, L. I., school boys, a large number of whom have receiving apparatus. A number of them are also members of the Sayville troop, Boy Scouts. They have organized a wireless class under the direction of First Class Electrician Dunkle, who is a Government operator at the station.

AMENT DR. COHEN'S NEW NAVY TYPE RADIO SET.

In the July issue of the *Electrical Experimenter* I took particular note of Dr. Cohen's improved Navy set and hooked up my set in the identical manner, and must say that the selectivity is wonderful.

However, for the benefit of amateurs contemplating using Dr. Cohen's hook-up, I wish to contribute a diagram which was tried out on my set and tested by me. It is similar to the improved style, except that every turn of inductance on the primary and secondary may be obtained.



Modified Hook-up and Construction for Dr. Cohen's New Wireless Receiving Set.

The amateur will find this to his advantage and for sharp tuning it has no equal. Contributed by

HARRY Y. HIGGS, R.E.

NEW CARNEGIE INSTITUTE OF TECHNOLOGY RADIO PLANT.

At a cost of $1,500 the Carnegie Institute of Technology, at Pittsburgh, Pa., is installing in the tower of Machinery Hall a new radio plant which will be the most powerful in that part of the country. The outfit will have a wide range over which it may communicate, the western boundary being Honolulu and the eastern Germany. Communication will also be established with other technical schools throughout the country which have radio equipment.

The other station is being installed for the use of the student Radio Club, an organization of electrical students. The equipment of the new set consists of a 10-k.w. motor-generator of the latest design and an Audion detector.

If you are a "newsstands reader," look sharp next month. We are changing the heading of our cover to make it more readable. You will like it, too.

A GEISSLER TUBE EFFECT.

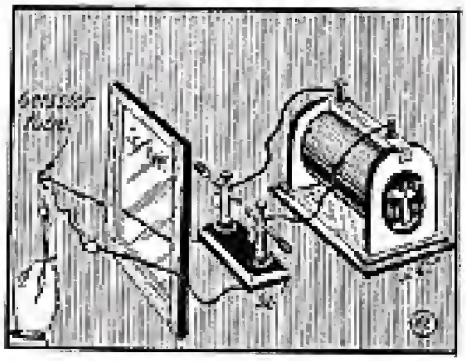
Connect a small Geissler tube to a gas engine or other small spark coil and shunt a spark gap around it, as indicated in sketch. Now adjust the gap so that when the coil is started the discharge will *just fail* to pass through the tube.

If the setting has been carefully made the coil may now be operated without producing a glow in the tube *as long as the tube is kept in the dark.* If a light from the spark gap or any ordinary light be allowed to fall on the tube a discharge will begin at once and will continue as long as the coil is operated. The current may be cut off at any time and the performance repeated indefinitely.

A rather interesting way of showing the effect is to "light" the tube with a match. For the success of the experiment the adjustment must be such that a very slight change in conditions will cause a discharge. The gap must be set apart as widely as possible and the vibrator of the coil should operate very steadily.

My explanation of the effect obtained is that the light thrown upon the tube ionizes the gas, making it more conducting and thus lowering the potential needed to produce a glow discharge to a value below that of the applied potential.

With used Geissler tubes the effect is very difficult to obtain if the regular sealed-in electrodes are used. Temporary condenser electrodes are made by wrapping



Light of Match Starts Spark Through Tube.

tinfoil bands around the tube near each end and the coil leads are connected to these. Contributed by S. KRUSE.

OVER 4,000 MARCONI RADIO MEN IN EUROPEAN WAR.

Presiding at the annual meeting of the Marconi International Marine Communication Company, Godfrey Isaacs expressed the regret of William Marconi at his inability to be present.

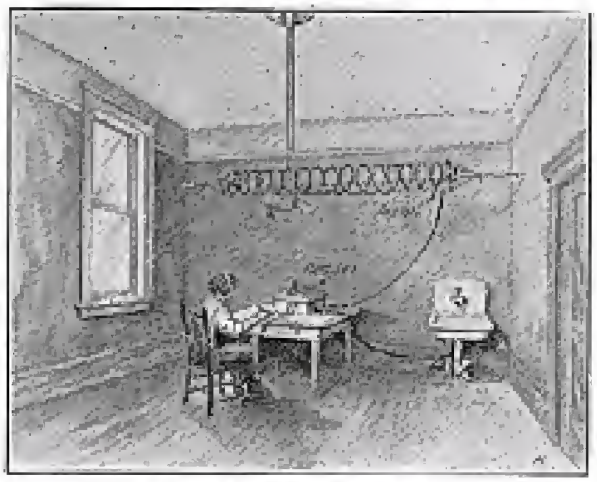
Mr. Marconi, said Mr. Isaacs, had been called upon by his Government and had joined the engineering staff of the Italian Army in order to superintend the organization of its wireless communications. At no time had the value of Mr. Marconi's inventions been more prominently emphasized than since the outbreak of the war, and when peace was obtained an interesting chapter might be written of the part played by the 2,000 Marconi stations fitted upon vessels of the mercantile marine.

Over 4,000 Marconi operators, said Mr. Isaacs, were in the service of the British Army and Navy, and the Admiralty had, on more than one occasion, expressed appreciation of the resources and courage displayed by the men.

Now is the best time of the year to erect an aerial or to overhaul an old one. Better get busy.

SPIRAL INDOOR AERIALS.

Where aerials are desired for wireless experimental purposes, etc., in apartments and other places where it is not desirable



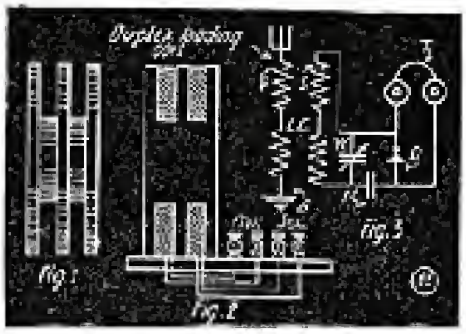
Spiral Antenna for Small Spaces.

to place long stretches of wire on the roof, the newly devised spiral aerial will be found very suitable for the purpose. This form of aerial, of course, possesses a large amount of inductance in proportion to its actual length when opened up. It can be used in an ordinary room, and as it may be made with a large number of turns in same, spaced even as close as ¼ to ⅜ inch, it can be seen that the inductance will reach a large value. Hence its receiving activities and also wave length capacity will be quite appreciable.

It has been stated that with this form of aerial it has been possible to pick up radio messages over distances of 1,500 miles and more. Strings may be used fastened to each turn in the helical aerial, so as to help support same in a straight line, or nearly so, between the end spreaders. These spreaders may be made of two crossbars of wood. Two heavy wireless insulators placed in either suspension rope supporting the aerial will insulate it nicely. It can be composed of 60 to 100 turns or more of No. 14 solid conductor or stranded cable with a turn diameter of 1 to 1½ feet.

A DUPLEX LOADING COIL.

The following is a description of an instrument which should be found in every radio station. It is known as a duplex loading coil, as it allows both the primary and secondary circuits of a loose coupler to be adjusted to long wave lengths. If inductance is added to the secondary circuit and that inductance inductively coupled to the primary circuit very good results will be



Making a Duplex Loading Coil.

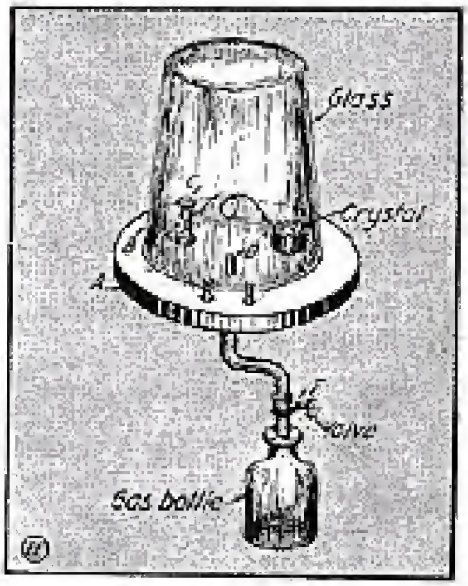
obtained. Of course, increased capacity could be added to the closed circuit, but it has been found that for the loudest signals the inductance employed should be considerably greater than the capacity. The device which will now be described consists of two coils having coupling between them; one coil being connected in series with the primary and the other in series with the secondary of the loose coupler.

Obtain three circles of ½-inch wood 5 inches in diameter and two discs 4 inches in diameter. Glue these together so that they will appear as in Fig. 1. Wind one of the grooves full of No. 26 S. S. C. wire and the other full of No. 30 S. S. C. wire. The wire should be wound on roughly, crossing the turns as much as possible. Enamel wire should not be used. The coils may then be mounted on a base as shown in Fig. 2, the ends of each coil being brought out to binding posts. Connect up as shown in Fig. 3.—Contributed by IRVING BYRNES.

GAS JACKET FOR DETECTORS.

Herewith you will find notes and drawing on constructing a new form of detector. All the material can be obtained around the experimenter's workshop.

In the drawing A is a circular base having a groove B about ¼ inch deep and the diameter of a good sized jelly glass. C is a detector of the cat whisker type,



Detector in Gas Chamber.

with connections to two bindings as usual. At D a short length of glass tubing is put through the base. Great care must be taken so that it will fit tight.

The detector stand should be firmly fastened down and the glass tubing allowed to go through the table to which the detector is fastened.

Then adjust the detector; put the glass over it and connect a piece of rubber tubing to D. This tubing is connected to a bottle of hydrogen gas which may be caught by a downward displacement of water, etc. A pinchcock should be fastened at V. One will be surprised at the increase in the strength of the signals.

Contributed by RAD COOVER.

[*This suggests a good field for research by the radio experimenter. Tests of different temperatures would also be worth while.*—Ed.]

The correct time by wireless from Arlington, Va., will check the clocks and watches at Tobin & Carbour's jewelry store in Springfield, Ill.

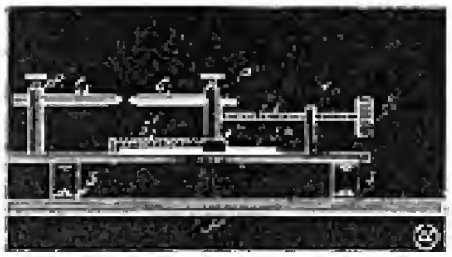
HOW TO MAKE IT

This department will award the following monthly prizes: FIRST PRIZE, $3.00; SECOND PRIZE, $2.00; THIRD PRIZE, $1.00.
The idea of this department is to accomplish new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 will be given; for the second best idea, a $2.00 prize, and for the third best a prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings.

FIRST PRIZE $3.00.

SIMPLE ARC LAMP.

A simple hand-feed for arc lamps is given below. At C C are the carbons. P P are standards. I have large ones so as to hold large carbons. S S are brass supports, which I use to hold base above



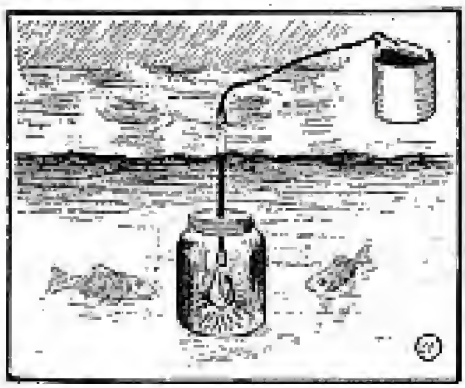
Efficient Hand-feed Arc Lamp.

table J. S' is a spring used to hold lock P', which is soldered in detector cup D, which slides in a brass slide about 6½ inches long. B is 4 inches of threaded brass rod which screws through support W, which has a threaded hole in it. K is a typewriter knob. The base is 11 by 3 inches and is of wood or slate. The wire to carry the current can be fastened to same place as the carbons are, or can be held by separate binding posts placed on the base. I hope that this contribution will be of some use to the readers of *The Electrical Experimenter*. Contributed by

EDWARD RHOADES.

AN ELECTRIC LURE FOR FISH.

Every good fisherman knows that a light will attract fish. A simple light can be made by taking a pint fruit jar, cutting a ¾-in. hole in the top of the cover, inserting a piece of gas pipe in the hole and soldering it to the cover. Insulated wires are run through the pipe, and a small electric globe is attached to the ends in the



Luring Fish by Electric Lamp in Bottle.

jar. The other ends of the wires are attached to a pocket battery. The jar is placed under water and the light turned on, which attracts the fish.

SECOND PRIZE $2.00.

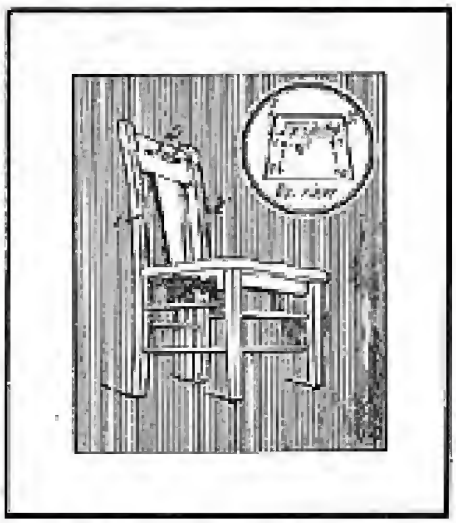
AN ELECTRIC "GOAT" FOR LODGES.

I give herewith a sketch of an electrically charged chair, and below, a brief outline of method of setting up same.

This chair will afford unlimited amusement in your office and probably rid it of a few chair warmers, and for lodge "initiations" it is the boss stunt.

Drive four small wire brads (a) into the under side of chair seat, letting just the points appear on the upper side of seat. With a fine nail set drive them back so that they remain just below the surface.

Fasten a small induction coil (c), and a battery (b) under the seat, soldering the secondary wires (f) to the ends of the brads (a). The parts of the switch (d) can be made from small strips of brass or



An Electric "Goat" Chair for Lodges.

copper, and screwed to the back of chair, as shown. The switch can be covered up by fake upholstery, etc.

Run the wires (e) down the back of chair to coil and battery, keeping them out of sight as much as possible. The switch (d) is concealed by a pad or drape of some kind thrown over the back of the chair, as aforementioned and the chair is ready for the first victim. When said victim leans back against the switch (d), closing the battery circuit with the coil (c), the *fireworks* begin. The coil may be a ¾ to 1-inch spark coil, and it is well to cover over the bottom and legs of the chair with cloth etc. Contributed by

C. F. CONANT.

RECIPES FOR ERASING FLUID AND CLEANING FILES.

For obliterating ordinary script, prepare a solution of chlorine gas in water. Take a freshly written copy and wash repeatedly with this solution and then with some lime water. This will neutralise any acid which may be left.

The following suggestion may be useful to those making use of steel files:

Thoroughly clean the file from any grease, oil, alkali, soda or potash and dip it into a solution of 1 part nitric acid, 3 parts sulphuric acid, 7 parts water, by weight, for from five seconds to five minutes. Then wash in hot water; dip in lime water and oil to prevent rusting.

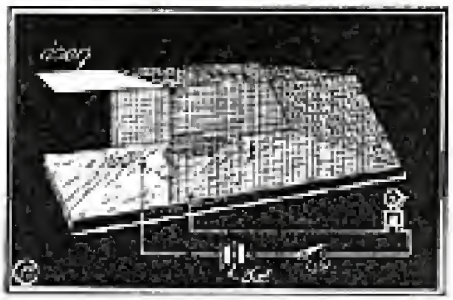
Contributed by C. J. ENGLESTEAD.

THIRD PRIZE $1.00.

AN ELECTRIC MOUSE TRAP ALARM.

The diagram herewith given depicts a novel little mouse trap alarm attachment.

Near the "trap" door is driven a nail so that when the door of the trap shuts it



Mouse Trap Alarm.

will touch the nail firmly. Two wires are fastened, one on the nail and the other to the trap, and connected up, as shown in diagram. When Mr. Mouse enters and attacks the cheese, the door closes, which causes the current to flow and rings the bell.

Of course this alarm is not always necessary, but those wishing a mouse trap alarm for traps located at a distance will find this most useful.

Contributed by BERNARD COHEN.

A POCKET-SIZE BATTERY RHEOSTAT.

A pocket regulator for battery currents is made from a piece of small glass tubing,

Simple Pocket Size Rheostat.

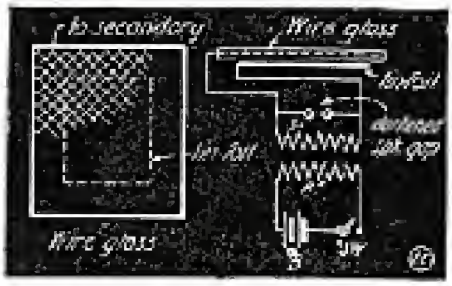
carbon grains, a match, tinfoil and a knob.

The match is fastened into the knob and covered with tinfoil, so that it will slide freely in the tube. Stop the other end with tinfoil and fill in the ¾-inch space with carbon grains. To regulate this move the match in and out.

Contributed by J. H. WILSON.

AN INTERESTING EXPERIMENT WITH "WIRED GLASS."

What might be termed "an interesting and peculiar spark effect" can be carried out by procuring a piece of window glass, with chicken wire made into it, commonly used in factory windows and doors. Now shellac one side of the glass and place a sheet of tinfoil on it having a smaller area than the glass. Before placing the tinfoil



"Wired Glass" Gives Spectacular Spark Effects.

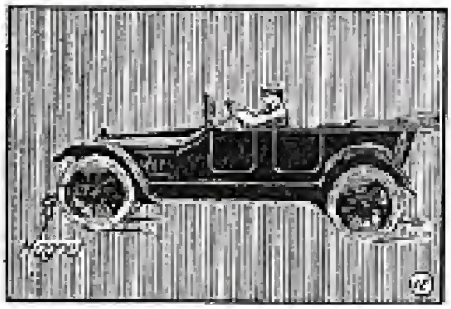
on, paint it black, and this face shall be toward the glass. Break off all the wires around the edge of the glass except one, and this is used for one connection as shown. Now, by connecting a 1-inch or, still better, a 2-inch coil to this glass arrangement and darkening the spark gap of the coil in a paper or wooden box, and taking the whole in a dark room, a most wonderful phenomenon will be noticed. When the current is turned on the glass will all light up with a violet hue in the form of the wire and little bubbles in the glass will become fluorescent, each in a different color, probably due to gas formed when the wire was plunged into the molten glass.

Contributed by

JOHN SEDGWICK.

SO YOU WON'T HAVE TO "GET OUT AND GET UNDER."

Have you ever leaned back among the cushioned comfortableness of your motor car on a scorching hot day, when your car went spinning along wafting delightful and fragrantly cool breezes to you, and blessed the wonderful invention of this means of refreshment? when bang! would come a loud report and the blissful trend of thoughts would be broken, your ease disturbed to the extent that you would vexatiously have to "get out and get under" to fix that "tiresome" tire. But at last has been found a remedy which will obliterate the thoughts which usually give vent to profane expression, significant of a punctured tire.



Magnets on Autos Pick up Tacks and Nails.

This aid has come in the form of a powerful electro-magnet, which may be attached in the front of the wheel or wheels of any *fixed* vehicle, as illustrated herewith. Any steel or iron particles, such as nails, tacks, etc., lying along the road will be picked up by this magnet, and thus prevent a puncture. If a truck or automobile is to be used a magnet may also be adjusted to the rear wheel, so as to protect the rear tires from such mishaps as aforementioned, and this will be found very serviceable should it become necessary to back the vehicle up.

Sketch is herewith shown as to how the magnet is applied. This device is very practical, and at the end of a long ride or trip, if the rider or driver will examine his magnets, he will realize how many times his tires were endangered, but thanks to my invention, saved! Contributed by

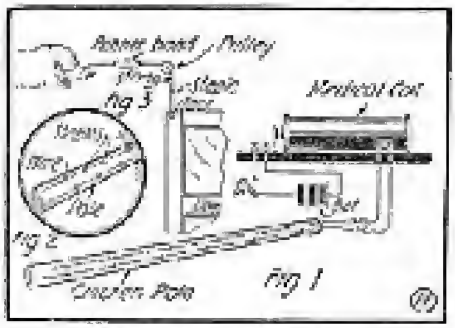
HARRY S. PAINE.

"SOME" CHICKEN THIEF ALARM.

I herewith give a suggestion which I am sure will remedy and comply with all demands of the suburban districts where the theft of poultry from the chicken houses is executed without detection.

Procure a medical or spark coil, a few dry cells, a tack, some bare copper wire, insulated wire, a switch and a few staples.

We will first consider the pole on which the chickens rest at night. Cut two single pieces from the bare copper wire a few inches longer than the pole, and by means of small staples tack the wires about ¾ inch apart along the entire length of the pole as shown in Fig. 1. (Fig. 2 gives a top view of the pole showing how wires, etc., are arranged.) Then place the coil in a corner and, after removing both electrodes from the binding posts on the side of coil, connect one insulated wire and



Electric Chicken-Thief Alarm.

lead it to one of the bare wire ends, as shown proceeding from the chicken pole. By means of tape, insulate the connections well. The other connections may be made by following the diagram, which is self-explanatory.

The switching mechanism of the device is now constructed. Although very simple, it controls the entire operation of the instrument.

Drive a tack in at the top of your door. Procure a string about 6 feet long and in the center of it fasten a rubber band as shown. Fasten the string to the tack on the door, drive a small staple about 2 inches above and pass cord over a pulley to the switch handle as illustrated. Connect one point of the switch to one of the wires from the battery, and the handle of switch to one post on coil. The instrument is now completed and ready for operation.

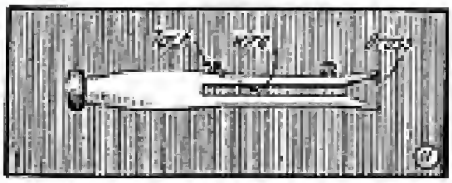
As soon as the intruder opens the door the string pulls the switch handle over to the switch point, both of which are in circuit, and naturally the coil is actuated. This sends a high-tension current through the bare wires on the pole and the chickens clutching it receive a "shock" and leap wildly about, cackling, and otherwise venting their disapproval. This will arouse the owner, and the unwelcome visitor will be welcomed in a manner that he (the owner) sees fit. Contributed by

WILLIAM WARNECKE, JR.

A HOME-MADE WIRE TESTER.

Many times there is a hurried demand for a reliable and sure wire tester to test some wire efficiently. The following is almost one of the simplest conceivable. Articles necessary are: A common clothes pin, a sharp-pointed nail or carpet tack, a binding post, some very small tacks and a sheet of brass or metal.

First cut out a thin brass strip the exact length of one of the jaws of the clothes pin and fasten it on by some very small



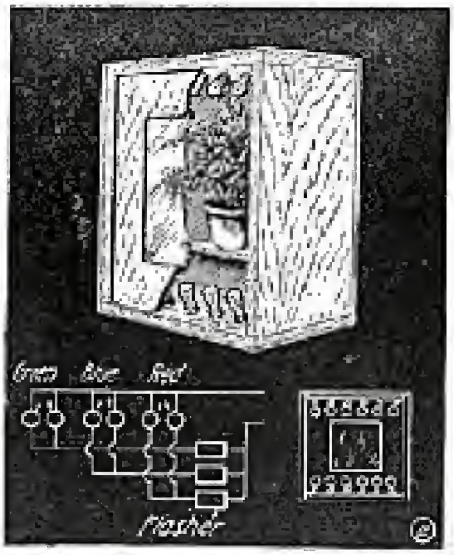
Test Clip Made From Clothes Pin.

tacks. (The heavy line in the drawing denotes the strip of brass.) Fasten it on either one of the jaws of your pin and also attach a binding post as shown. Now drive a sharp-pointed nail or tack about 1½ inches above the binding post and your tester is complete. It works as follows: Presume that you wish to test some insulated wire. You push the tester into the wire so that it is firmly gripped by the jaws of the tester. It is just the same as if the wire to be tested was a clothes line and you were hanging up wash by the use of clothes pins. The sharp-pointed nail or tack pierces the insulation on the wire until it has the bare copper wire thoroughly in its grip. There's where the excellent connection comes in and although the clothes pin, in fact, the whole device, looks so odd and simple, yet it cannot be overestimated in its various uses.

Contributed by HENRY BROWN.

COLORED LAMPS IN WINDOW DISPLAY.

One of the most attractive window displays can be made by using colored lamps connected to flashers, giving an illumination variable in color. The advantage of this effect is that it has an almost universal application. Any kind of goods can be shown to advantage.



Color-Changing Colored Lamps Give Beautiful Window Display.

A box with an opening in front as indicated is painted a dead black inside and the back is lined with black velvet. Red, green and blue lamps are used as shown, the wir

ing being very simple. The lamps being shielded from the observer and the inside of the box being black, the goods exhibited appear to undergo mysterious changes in color.

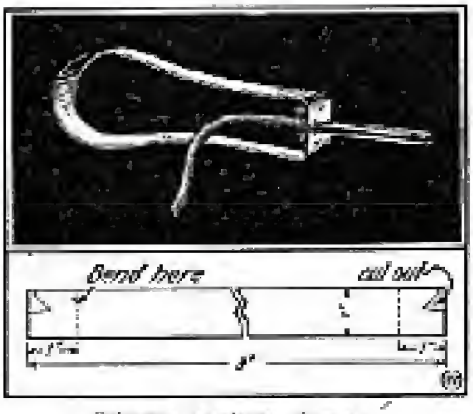
The number of lamps to be used depends upon the size of the box, and likewise upon the surroundings. Twice as many blue lamps should be used, for their intensity is lower than the green or red lamps. If the lamps are 60 watt Mazda, the number of lamps shown in the illustration will be sufficient to display in a box with an opening 30 inches square. The more lamps used, however, the more striking is the effect.

This sort of window display should be of service to the florist who is intending to advertise his flowers. The flashers can be of the thermostat type, which operate automatically and are very cheap to purchase. The best method of switching on the various colored lamps successively, however, would be by means of a small motor-driven flasher with rotating metal segments and brushes in the place of the thermostatic flashers mentioned. With a little ingenuity on the reader's part such a commutator flasher arrangement can be easily improvised. Contributed by

A. FLORIA.

A WIRE INSULATION REMOVER.

To scrape the insulation off wire with a knife blade or pliers is a very slow and tiresome job, as every experimenter knows. In order to make this work easier, the fol-



Effective Insulation Scraper.

lowing directions may be employed:

Procure a piece of spring steel about 9 inches long and 1 inch wide (a heavy clock or photograph spring will serve the purpose), and with a file make a V-shaped notch in each end, as shown in the drawing. One side of the notch should be made a little shorter than the other, so that the wire can be more easily be inserted. Now bend over carefully the ends at the dotted lines as illustrated, because spring steel when cold is very apt to break. It is a good idea to heat the spring where it is to be bent, over a bunsen burner, so as to insure its flexibility. The notches should then be sharply ground and the scraper shaped as sketch shows. The scraper is used by inserting the wire in the notch, pressing the sides together with the hand and drawing the wire through.

Contributed by

FRANK J. L. HAVERLAND, JR.

AN ELECTRIC WINDOW TAPPER.

This little device can also be termed a "show window attractor," and is commonly used in electrical and other stores. To construct, the following directions will be serviceable:

A box 6 inches long by 3½ by 4 inches, with a hinged cover, is necessary. Mount on the cover with screws, a common electric bell, minus the gong. A switch is fastened on side or top of box. A 3-volt "Radio" dry cell is preferable, as it eliminates the bulk of other batteries, giving only 1½ volts. A diagram of the wiring is given herewith. The bell should be

Window Tapper Made From Ordinary Bell and Battery.

mounted about 1 inch over the cover from the edge, and the best effects are obtained by placing the box in a corner of the store window and bending the hammer of the bell to give the proper adjustment to the window pane.

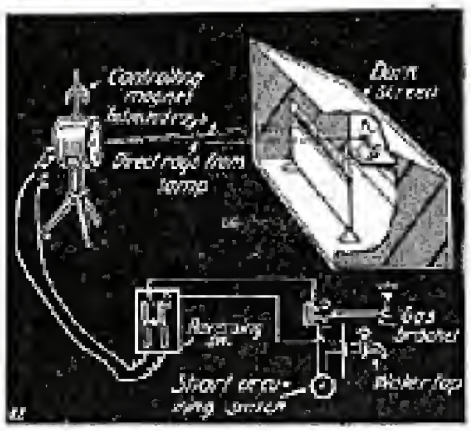
The bell will work intermittently or constantly, as desired, and the hammer vibrating against the glass of the store window produces an ear-shattering noise, which naturally attracts the inquisitive passer-by. Contributed by

W. R. WELLS.

DETECTING ELECTRIC CURRENT BETWEEN WATER AND GAS PIPES.

Those having a sensitive galvanometer at hand will find it interesting to conduct experiments to see if they can detect any electrical potential differences between the gas and water pipes in their house or laboratories. In some cases this amounts to a considerable voltage.

The sketch herewith shows how a reflecting galvanometer is arranged with a scale and a lamp which throws a beam of light through the small hole in the scale proper. This beam of light strikes the small mirror in the reflecting galvanometer and reads across the scale by re-



Detecting Stray Earth Currents.

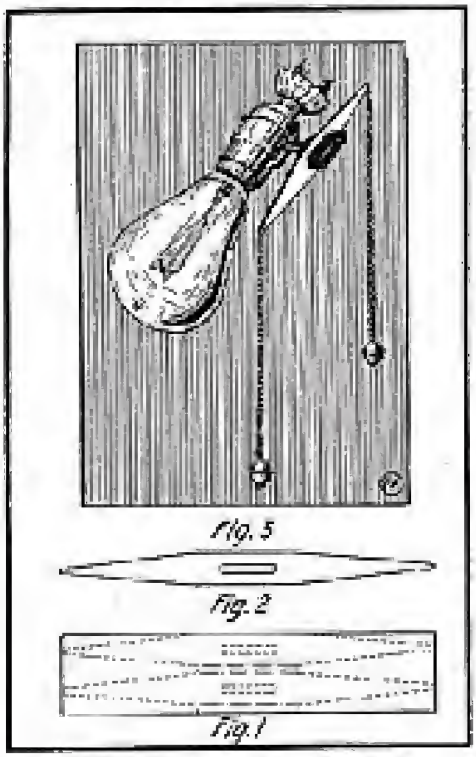
flection, according to the magnitude of the current passing through the galvanometer windings or coils.

An English experimenter recently stated that he had measured considerable electrical current potentials existing between water and gas pipes in his house and in some cases he detected 1/60 of a volt. He also very ingeniously arranged a method of telegraphic signaling with a friend residing about ¼ mile away from his house. This signaling was carried out by having his galvanometer connected across the gas and water pipes and his friend simply arranged a Morse key or push button across the gas and water pipes in his laboratory ¼ mile away.

This experiment is very interesting and it hardly seems possible that such an arrangement would work over distances of ¼ mile, but it is a matter of fact that it has worked, and further experimenting along this line would seem indeed worth while.

A CHAIN PULL FOR KEY SOCKETS.

Here is a valuable idea which your readers can use successfully on any socket key of their electric lighting system. Only a piece of stiff metal and a gilt chain or cord is necessary. Mark out (see Fig. 1) and then cut around the dotted lines made. Fold over and put on finishing touches as il-



Chain Pull Attachment for Key Sockets.

lustrated in Fig. 2. Then slip the novelty into your key of socket and it will work simply, easily and reliably. It has the "chain pull" effect, and you will find if you make one that you will make more and more until there is one on every socket key.

Contributed by

FRED WARNER.

INLAND WEATHER FORECASTS BY WIRELESS.

The distribution of marine weather forecasts and warnings by radio-telegraphy is well known, but the use of this method of conveying weather information to inland dwellers is about to be tried for the first time in this country. Arrangements have been made to send out a wireless forecast daily, between 12:45 and 1 p. m., from Illiopolis, Ill., to all receiving stations within a radius of 125 miles. The messages will be sent slowly (10 to 12 words a minute) for the accommodation of amateur operators who are not sufficiently expert to receive faster.

Under this heading we will publish every month useful information in Mechanics, Electricity and Chemistry. We shall be pleased, of course, to have our readers send us any recipes, formulas, wrinkles, new ideas, etc., useful to the experimenter, which will be duly paid for, upon publication, if acceptable.

EXPERIMENTERS APHORISMS.

In the following, we wish to give to the Experimenter some hints as to the use of the different ingredients and how to work them:

(1) Always bear in mind that exact working of a formula requires ACCURACY, CLEANLINESS, PATIENCE, and SKILL.

(2) Know what you are about, before you start to experiment.

(3) "THE HISTORY OF FAILURES IS THE HISTORY OF SUCCESS" goes an old adage, and it applies well to the experimenter.

(4) Many times impure, wrong or deteriorated raw materials spell FAILURE instead of SUCCESS.

(5) A great many of the chemicals and ingredients required, cannot be obtained from drug stores; buy them at a reputable supply house.

(6) BEFORE CONDEMNING A FORMULA, be sure the fault does not lie with the manner of handling it, or the purity of the ingredients.

(7) Be sure to mix the materials comprising a certain formula in the proper sequence.

(8) When starting to prepare a mixture, especially one containing liquids, ask yourself: "IS THE SPECIFIC GRAVITY CORRECT, AS INDICATED BY A HYDROMETER? IS THE TEMPERATURE RIGHT? IS THE QUANTITY OR WEIGHT RIGHT?

(9) Acids and water, when mixed, should be manipulated in the proper manner, i. e., THE ACID SHOULD BE POURED INTO THE WATER, and not vice versa, as the solution is liable to be forcibly ejected from the containing vessel and into the mixer's face.

(10) For any kind of SYSTEMATIC WORK, a floating THERMOMETER and HYDROMETER, as well as measuring glasses and scales, should always be provided, as GUESSWORK is EXPENSIVE, and SOMETIMES FATAL.

(11) Put labels on ALL bottles, boxes and packages with FULL INSCRIPTION as to their contents, it will avoid troubles and mistakes.

(12) Remember that a beginner cannot expect to make articles AT FIRST, which will compare with regular manufactured products.

FORMULA NO. 11.
BLUINGS FOR METALS.

Blue Finish.—Clean the article very carefully. Make a mixture of 1 part of *Nitric Acid*, 10 parts of *Water*. Apply the liquid with a sponge until a blue film is produced. Wash with warm water; dry with a flannel and wipe with *Linseed Oil*.

Bluing Brass Like Steel.—Take a leaden vessel, put in some *Hydrochloric Acid* and very little of *Arsenic Acid*. The brass article is laid in this vessel and soon assumes iridescent tints. Remove when the desired shade is obtained; wash with water and dry.

Bluing Gun Barrels.—Dissolve 4½ oz. of *Hyposulphite of Soda* in 1 qt. of *Water*. Also dissolve 1½ oz. of *Acetate of Lead* in 1 qt. of *Water*. Mix the two solutions and bring to a boil in a stone pot. After having thoroughly cleaned the barrel, coat with the hot solution, using a piece of sponge tied to a stick of wood. When color develops, wash with water, dry with a piece of flannel and finish with *Boiled Linseed Oil*.

Oxidizing Silver.—Boil the article in a mixture of 5 oz. of *Bromine*, 120 grains of *Bromide of Potassium*, 10 oz. of *Water*, in an earthenware pot for three to five minutes. Remove, dry and polish.

Bluing of Steel.—Heat the steel over a flame of alcohol and varnish with a mixture of *Prussian Blue* and *Alcoholic Shellac Varnish*. Use a thin varnish. Of course this is only an imitation of bluing, and the article has to be lacquered to make it wear.

Heat Bluing of Steel.—This formula is used to blue revolver parts, vibrators, steel knives, etc. Mix carefully together 25 parts of *Trichloride of Antimony*, 25 parts of *Fuming Nitric Acid*, 50 parts of *Hydrochloric Acid*. Tie a rag to a stick and apply the mixture freely. After rubbing the article with a flannel it may be polished on a polishing head with a green oak wheel until an even, clear blue is obtained.

Revolver Barrel Bluing.—Clean the barrel with emery cloth; remove all grease with lime and polish the surfaces. Take fine and clean wood ashes in a muffle, put the barrel in the middle and heat the muffle to a temperature of *cherry red*. With a pair of tongs, remove the article from time to time to see if a dark blue can be obtained when cooled in the air. When the desired color is obtained take the barrel out and let it cool in the air. Finish with *Boiled Oil* and polish.

Bluing Steel.—A very simple process is the following: Melt *Saltpeter* in an iron pot. Clean and polish the steel article and dip in the saltpeter until sufficiently blued. Remove and cool at once in *Paraffine Oil*. Wipe with a flannel rag and dry in sawdust.

Bluing Silver.—The oxidizing of silver is produced by placing the articles in a solution of *Liver of Sulphur*, diluted with *Spirits of Sal Ammoniac*. Allow to remain until the desired dark blue-black tone is produced; then wash in water, dry and polish.

Durable Blue on Iron and Steel without Heat.—Take a stone pot and mix together 2 part of a 5%-% solution of *Red Prussiate of Potash*, 1 part of a 5%-% solution of *Ferric Chloride*. Dip the articles until the desired effect is produced. When dry, the articles may be lacquered. S. G.

SYMPATHETIC INKS.

I give below the formulæ for making sympathetic inks:

Formula No. 1.

Take some pure lime juice, or lemon will do, and write with it on a paper. Then heat over an alcohol lamp and the writing will come out brown.

Formula No. 2.

Dissolve some sulphate of iron in water and write with it. Heat and the writing will come out dark brown or black.

Formula No. 3.

Dissolve some chloride of potash in water. Write with it and heat. The writing will come out brown.

Formula No. 4.

For purple invisible ink. Take some salicylate of soda and dissolve in water; don't make the solution too strong, or it will turn brown where you write with it. Reagent. About 50 per cent. solution of tincture of iron applied with a brush. The writing will come out purple.

Contributed by ELLISON FRAZER.

Aluminum Lacquer.—For aluminum dissolve 100 parts *Gum Lac* in 300 parts *Ammonia*, heating for one hour over a *Water* bath, paint the thoroughly cleaned aluminum with the varnish and heat it to about 350 degrees Fahrenheit.

Polish for Varnishing Wood.—Shake well together 1 pint *Vinegar*, 1 oz. *Alcohol*, 1 pint *Linseed Oil*, 1 oz. *Butter of Antimony*.

INTERESTING EXPERIMENTS FOR THE AMATEUR CHEMIST.

The following experiments can be performed with household chemicals:

If you possess a battery giving from 4 to 20 volts you can perform the following experiment, which is particularly interesting on account of the variation of results, with apparently the same conditions:

Immerse two pieces of brass in a strong solution of common salt or sal-ammoniac and water. Connect one piece to the positive wire and the other to the negative, taking care that the brass pieces do not touch each other.

After the current has passed for one or two minutes the solution will become colored, and if the process is continued a colored pigment will be precipitated. The color of the precipitant varies considerably and may be either red, purple, green, blue, orange and possibly others, depending on the strength of the current and the composition of the brass.

The Grand Rapids can be made as follows: Fill a tumbler or test tube with water, throw upon its surface a few fragments or thin shavings of camphor gum and they will instantly begin to move and acquire a motion both progressive and rotary, which will continue for a considerable period of time. If the water be touched by any greasy substance the floating particles will reverse their course and dart back and, as if by a stroke of magic, be instantly deprived of their motion and vivacity.

A Ritual to Jack Frost is produced by dissolving camphor gum in warm spirits until the spirits will dissolve no more; pour some of the solution into a cold test tube or tumbler and the camphor will instantly crystallize in beautiful forms like trees and landscapes.

This next experiment sounds as if it were "bigger," but it is not. Dissolve 150 parts of hyposulphite of soda in 15 parts of water and pour the solution slowly into a test tube or tumbler which has been heated in boiling water; fill the same about one-half full. Dissolve in another glass 100 parts of acetate of soda in 15 parts of boiling water. Pour this solution slowly on the top of the first in such a way that it forms an upper layer, without mixing the solutions. The two solutions are then covered over with a thin layer of boiling water and allowed to cool. Lower into the test tube a wire, at the extremity of which is fixed a small crystal of hyposulphite of soda. The crystal traverses the solution of acetate without causing trouble, but crystallization will immediately set in as soon as it touches the lower hyposulphite of soda solution. When the hyposulphite of soda solution becomes crystallized, lower in the upper solution a crystal of acetate of soda suspended by another wire and this will crystallize the same as the other solution. Contributed by

HAROLD B. FINKELSTEIN.

AN ENT MAKING ELECTROTYPES.

I notice in the August last number of the *Electrical Experimenter*, page 169, an article on "Making Small Electrotypes," which, although excellent in its way, is capable of much improvement.

Mr. Sutton says, "Three cells of battery should be connected in series to do the plating." This seems not only absurd, but wasteful. One gravity (Zn-Cu-Cu. SO_4) is all that is needed. The writer has made many electros (beginning in 1891) and never used more than an E.M.F. of one volt.

Contributed by an "Old Experimenter,"

A. GALPIN.

WITH THE AMATEURS

AMATEUR RADIO STATION CONTEST.

Monthly Prize, $3.00.

This month's prize winner.

AN EFFICIENT EXPERIMENTAL STATION.

I present a picture of my wireless station which I should like to have appear in your Radio Station contest. The instruments, which are of my own make and design, have produced very satisfactory results. The receiving set comprises a loose coupler, two variable condensers, a fixed condenser, loading coil, galena and perikon detectors, high-pitch buzzer and 2,300 ohms head 'phones, mounted in a hard rubber box which measures 12x12x4½ inches.

On the right of the picture can be clearly seen an audion detector set with two Hudson filament bulbs, which can be also used as an amplifier. The front of the box is made of hard rubber and measures 11x10x8 inches. In addition to this set, a variometer is employed which increases the sensitiveness of incoming signals. I hear

Prize Station of Louis A. Kaplan.

NAR, Key West, NAX, Colon, and a number of long distance stations.

My aerial is 45 feet long, 40 feet high and consists of four No. 14 copper wires spread 2 feet apart. My transmitting set is composed of a ¼-kw. transformer, oscillation transformer, stationary and rotary spark gaps, glass plate condenser and a heavy sending key. Owing to a low aerial, my sending range does not extend very far, but I am heard clearly up to 20 and 30 miles.

LOUIS ARNOLD KAPLAN.

Bronx, N. Y.

AMATEUR WIRELESS STATION OF C. W. WATKINS.

Herewith I present photo which depicts my radio station and which I hope will appear in the radio station contest columns of your valuable magazine.

For sending I use a 1½ K. W. transformer, oscillation transformer, aerial loading inductance, rotary and quenched gaps, condenser, hot wire ammeter, relay key, sending key and aerial switch. With this tratemitting set I have been heard up to 200 miles; as far as Youngstown, O.

My receiving set, which was devised ex-

C. E. Watkin's Station.

clusively by Prof. M. E. Packman, of Dodge's School of Wireless, consists of a loose coupler, loading coil, variable and fixed condenser, two galena detectors and phones. Opposite the receiving set can be seen a large loose coupler, which is employed for long wave lengths and which can tune up to 10,000 meters. Mounted above the latter outfit is a wave meter built by Prof. Packman and myself, composed of variable condenser, inductance, buzzer, lamp and detector.

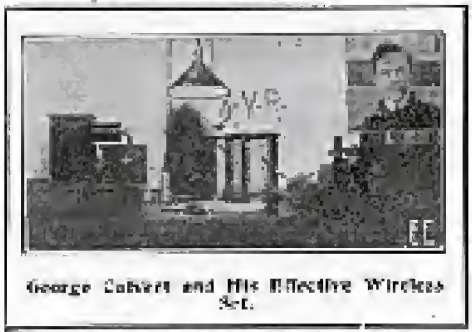
My aerials, of which I have three, constitute, respectively, a flat top 81 feet high at one end, 40 feet at the other by 94 feet long, and umbrella composed of eight wires and a one-wire aerial.

After four years of experimenting I can now obtain very satisfactory results with this station and can hear "N. A. A.," "W. S. L.," "N. A. R.," as well as other stations very well. My call is "9DI," and I would be pleased to communicate with anyone within my range.

Ashland, Ky. C. E. WATKINS.

GEORGE C. CALVERT'S WIRELESS SET.

I herewith submit a picture of my radio set for the Amateur Wireless Station contest. My aerial is made of No. 14 copper



George Calvert and His Effective Wireless Set.

wire, 200 feet long, 75 feet high, on spreaders 5 feet wide.

My transmitting set comprises the following: a ¼-kw. transformer, glass plate condenser, rotary gap (13,000 R.P.M.), with Leiix, hot wire meter and anchor gap. For receiving I use a loading coil, loose coupler, two variable condensers, a fixed condenser, audion and mineral detectors. The necessary switches are mounted on a panel.

When 2,000 ohm head 'phones are used I am able to hear "N. A. A." and "N. A. R." However, my 'phones are only wound to 1,000 ohms. My call is "8 V R" and I would like to arrange tests with anyone within my range.

I have read the *Electrical Experimenter* since it started and enjoy it very much.

GEORGE C. CALVERT.

Pittsburgh, Pa.

RADIO STATION OF W. MORRISH.

The photograph I submit herewith shows my Canadian wireless experimental station which I used at Gravenhurst, Ont., Canada.

This station performed very good service all around in both transmitting and receiving, and I hope shortly to send you photograph of my new radio station in England.

As may be seen from the photo, the transmitting set comprised the usual helix, a spark gap, "Auto" ignition coil, key and condenser. A specially arranged D. P.

William Morrish and His Canadian Station.

D. T. knife switch mounted on the center of the panel-board over the table switches the aerial and ground connections from transmitting to receiving, and vice-versa.

The receiving set included a home-made loading coil, which is seen mounted on the wall at the left, also a large size loose coupler with auxiliary tuning inductance, as well as variable condenser of the tubular type. Crystal detectors were employed as well as others.

W. MORRISH.

Mutley, Plymouth, England.

GREENFIELD, MASS., RADIO CLUB IS FORMED.

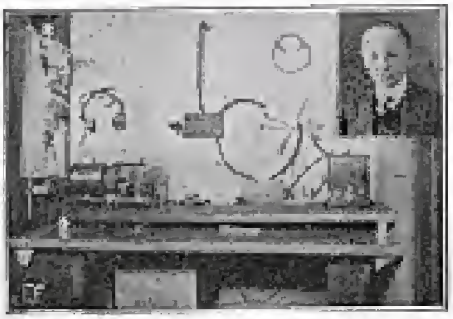
At a meeting held recently at the Postal Telegraph Cable Co.'s office, the manager of the company, Costas S. Theofan, brought about the organization of a wireless club in Greenfield, Mass., and it is named the Greenfield Radio Club. The club was formed with a membership of 15. The following officers were elected: President, Arthur Duchemin; vice-president, Howard S. Wing; secretary and treasurer, Costas S. Theofan. Communications from

amateurs within 20 miles from Greenfield are solicited by the club.

A few of the members are: Albert Kerner, Rolland Stratton, Brenton E. Perry, Raymond Hublett, Donald N. Dinsmore. The members of this club are mostly boys who are experimenting with wireless telegraphy. Albert Duchemin, of 26 Pond street, was the first of the local fellows to begin this line.

Radio Station of Marcus G. Limb.

Herewith is given photo of my wireless



Marcus G. Limb and His Radio Set.

outfit. My receiving set comprises a Murdock loose coupler, E. I. Co. variable and adjustable condensers, loading coil, universal and crystal detectors and transatlantic type 'phones. The two detectors are back of the receiving transformer. The following constitutes my transmitting set: A humming transformer, oscillation transformer, oil-immersed condenser, spark gap and a condenser in series with the ground to reduce the wave length.

I can send about 25 miles and on favorable nights I can get N. A. R. My aerial is 85 feet long, 40 feet high and has six wires in it.

Wooster, O. MARCUS G. LIMB.

Doughty Radio Station.

The accompanying photograph depicts my radio station located at Fairhaven, N. J. My aerial is of the inverted "L" type and consists of four No. 12 copper jacketed wires, 150 feet in length, spaced 2½ feet apart. It is supported by an iron mast 75 feet high and the lower end is attached to a pole 45 feet high. The lead-in is 50 feet in length and is taken in at the back of the building through porcelain tubes. My ground wire is connected to a water pipe which is driven into moist ground at a depth of 12 feet.

For receiving I employ Brandes' 2,000-ohm receivers, Amco receiving transformer, silicon and galena detectors, fixed con-

Mr. Doughty's Wireless Outfit.

denser and two loading coils of my own construction.

My sending set consists of a 1-inch spark coil, condenser and zinc spark gap, which is mounted on top of my coil case.

JOSEPH H. DOUGHTY.

Greenwich, Conn.

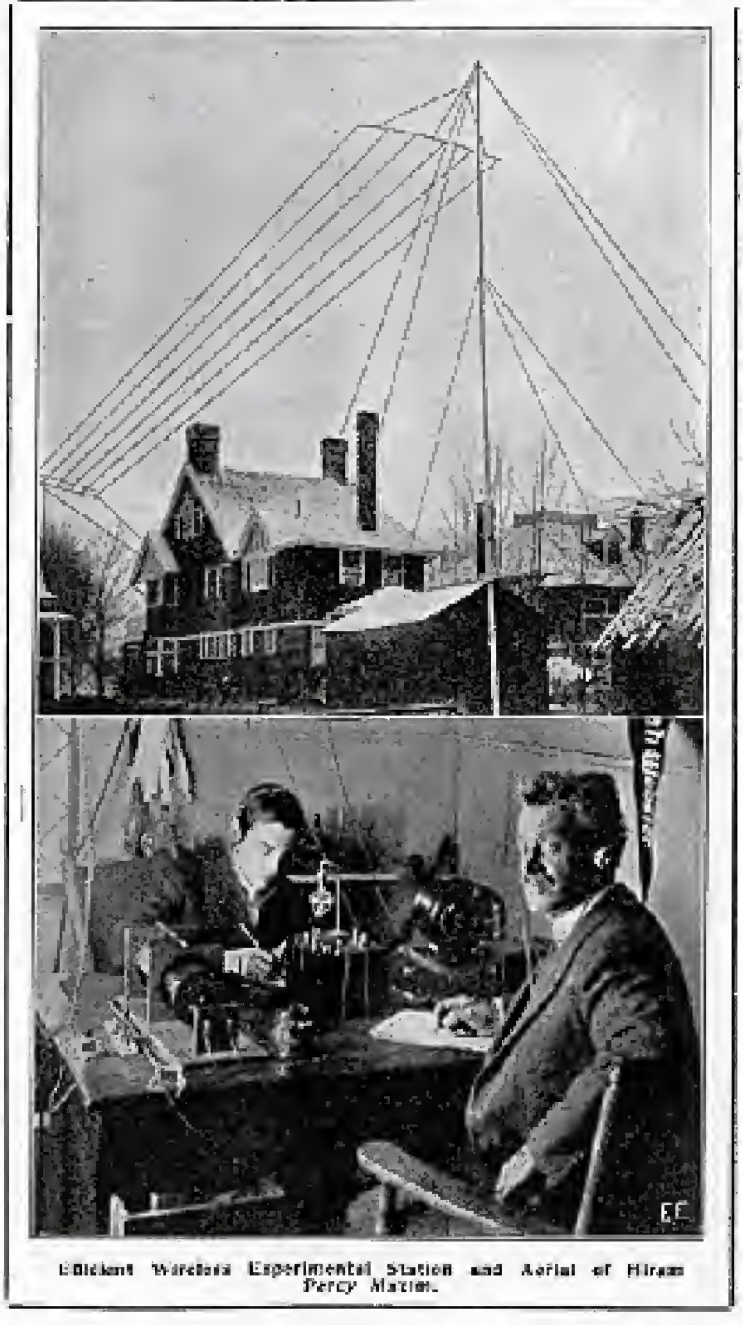
Radio Station of Famous Inventor

Herewith I submit photograph and description of my wireless experimental station.

The receiving station outfit consists of a large loose coupler by means of which I can get very accurate tuning, an Audion detector and variable condenser. The two sets of phones are usually connected in. The transmitting set consists of a 1 kw. specially made transformer, glass plate condenser, oscillation transformer, and a ¾ horsepower General Electric Co. motor running a specially built, enclosed-rotary spark-gap. Two aerials are arranged, one for sending on 200 meter wave length for distances less than 10 miles, and one for sending on 425 meter wave length for distances in excess of 10 miles. Five plates of the condenser are used for the 200 meter wave length and 10 plates added to these five for the 425 meter wave length. The outdoor equipment consists of a 60 foot mast at one end and a 50 feet mast at the other, 100 feet apart. The spreaders are 10 feet long and have 11 wires of stranded copper between them. The ground connection is carefully soldered and connected to ground at three places. This station can "work" points in Southern New Jersey, Northern Massachusetts and can receive Colon, Panama and ships at sea, when two or three days out of New York. The station holds a special license for the purpose of relay work in the American Radio Relay League. The call letters are 1ZM.

HIRAM PERCY MAXIM.

Hartford, Conn.



Efficient Wireless Experimental Station and Aerial of Hiram Percy Maxim.

WIRELESS AT MASSACHUSETTS "TECH" CAMP.

Far down in Maine, where the morning newspapers of the great cities are not received till after nightfall, the students at the Massachusetts Institute of Technology surveying camp have the baseball scores and news items posted on the bulletin before breakfast. In fact, it would be possible to post these items at night before the presses of the city papers have begun their work of printing, but for the fact that the receipt is after camp hours at night and there would be no one astir to read the bulletins if posted which received. This touch with the world is because the students have wireless receivers that catch the news. Technology camp has its own post-office, Technology, and is located on Gardner Lake, East Machias, about eight miles by road from the village. It is a summer school which transfers the work of practical surveying and hydraulic measurement from the limited city areas to the woods and ponds where actual work can be done on the commercial scale. There are about 130 students in the camp and a score of professors, and the students have in commission two wireless receiving sets.

RADIO CLUBS ATTENTION!

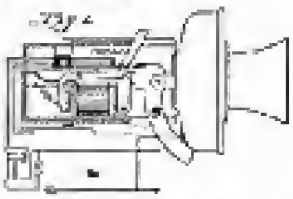
We are always pleased to hear from young Edisons and Radio Clubs. Send a write-up of your Club with photos of members and apparatus to-day to: Editor "Amateur Gossip" Section, The Electrical Experimenter, 233 Fulton St., New York City.

LATEST PATENTS

Automatic Telephone Switch.

(No. 1,145,820; issued to William C. Vide.)

An automatic telephone switch, so designed that the pressure of the ear against, say a watch case receiver S, on a pivoted arm C, will

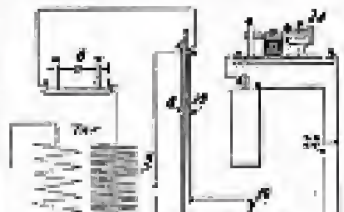


cause the switch springs, as received, to automatically control the cutting in and out of circuit of the telephone transmitter and receiver, instead of having to hang up the receiver in the usual way. A very good idea.

Wireless Receiver for Lighting Circuits.

No. 1,143,799; issued to Ross D. Avery.)

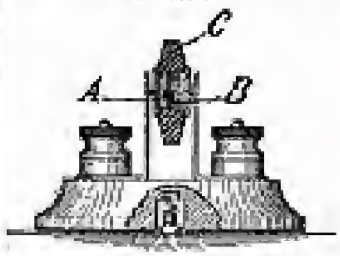
An ingenious wireless receptor, claimed to work on lighting lines by its inventor. The wires X, connect with an ordinary alternating current



lighting or power circuit. The current then passes through primary 2 and secondary 3 of a step-up, high-potential transformer. The current from the secondary transverses the small spark gap 6 and charges an electro-static plate arrangement 8 and 10, separated by an insulating plate 11. Whenever a sufficient charge rises between the plates 8 and 10, the plate 10 is attracted and in its movement actuates a switch 19, which in turn closes a local sounder circuit 22. It is claimed by the inventor that this arrangement will work on A. C. circuits and in adjusting the device the spark gap 6, is so regulated that the ordinary current from the secondary 3 will not jump the gap. Then when any wireless waves superimpose on the A. C. circuit and reach the apparatus, they will boost the current sufficiently to jump the gap and thus actuate the sounder 24, as evident from the foregoing.

Improved Mineral Detector.

(No. 1,144,338; issued to Lincoln T. Turner.)

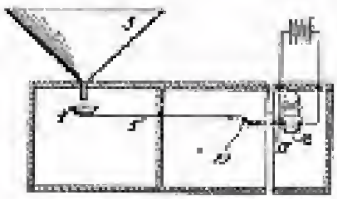


The well-known "Crystalo" detector now for sale on the market for some time. It employs two electrodes A and B; the former having a piece of sensitive mineral, such as the best grade natural galena. The electrode B consists of a mass of finely divided conductive material, such as aluminum-bronze filings or they may be carbon grains etc. These mineral electrode materials are carried in a rotatable casing C; so that the detector is quickly readjusted, by simply turning the container on its axis, between two supporting springs, as perceived. Thus, a number of sensitive contact points are practically always available with this ingenious form of detector construction.

Electric Rain Signal.

(No. 1,142,246; issued to Joseph J. Barrash.)

A useful device where a rain signal is desirable. The rain is caught by the funnel 3 and passed through a pipe 4 into a catch pan 5, which overbalances the pivoted lever 7. When rain falls and strikes the lever, it releases a sliding catch 16, connected by a spring or otherwise to

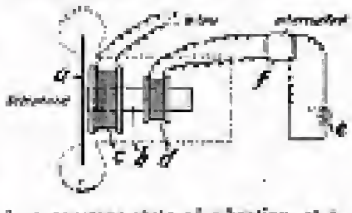


a spring switch 15, which closes the battery circuit for an electric alarm bell 18 or instead, this circuit may control an electric motor for closing windows or skylights.

Sound Enunciator.

(No. 1,145,551; issued to Francis W. H. Clay.)

The invention of this sound enunciator arranges to have the diaphragm A kept in a constant state of high frequency vibration by using for instance, a superimposing vibrating coil D, containing in its exciting circuit a source of electric current F, and a very high-speed interrupter E. It is claimed that if the diaphragm A is thus maintained

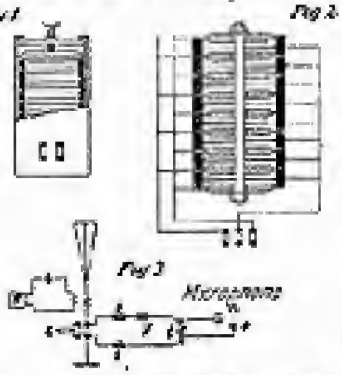


in a constant state of agitation, at a frequency above audibility, that the ordinary sound waves to be reproduced by the diaphragm from the telephone line coil C, in the usual way, will be much clearer and freer from distortion or false tones than in the usual way, where the diaphragm is allowed to vibrate by itself.

Condenser Transmitter for Radiotelephony.

(No. 1,145,027; issued to Walther Bentyn.)

A modification of the condenser transmitter, at one time used by Prof. Fessenden for radiotelephonic antenna current control. This patent covers a multiple disc condenser transmitter, as drawing shows. The dielectric spaces between the various metallic discs are varied and consequently the electrical condenser capacity, by creating various degrees of electric charge on the plates, through a circuit XYZ, made up of a battery; choke coils S S, and telephone induction coil T. The primary of this induction coil is hooked up with a microphone of the usual pattern M, and a battery E. The regular high frequency radiophone current charges the antenna through



an oscillation transformer and the high frequency generator G. The condenser transmitter is shown at 7.

Heat-Shield for Incandescent Lamps.

(No. 1,141,827; issued to Edward Redmond Holt.)

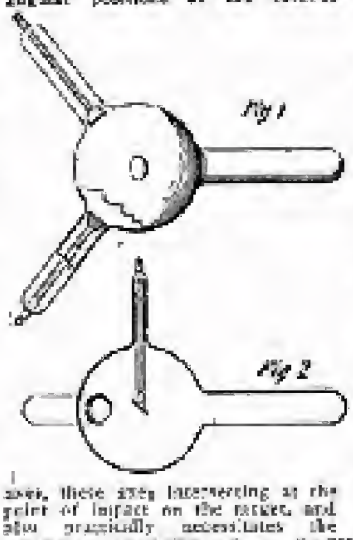
This invention relates to the provision of a glass vacuum chamber V, around the regular incandescent lamp B. The idea is to prevent excessive heat being generated from the lamp, especially when used in close proximity to a person reading, etc.

High-Frequency X-Ray Bulb.

(No. 1,147,185; issued to James E. Seeley.)

This invention relates to a double cathode X-ray tube for use with alternating currents irrespective of their method of production and especially with alternating high frequency currents.

The present invention consists fundamentally in the combination of a pair of cathodes and a single target, in such arrangement that both cathodes may focus on and bombard the target at a single focus point. This invention is effected by an arrangement of both cathodes on the same side of the plane of the impact face of the target; and the arrangement necessitates relatively angular positions of the cathode

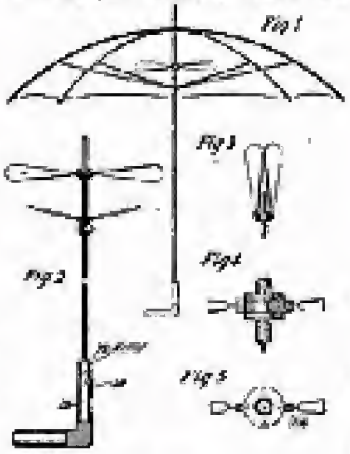


axes, these axes intersecting at the point of impact on the target, and also practically necessitates the placement of the target at an angle with the plane determined by the cathode axes. These features and others of more minor importance, accomplish the fundamental object of the invention; that object being to provide a tube capable of operating with alternating currents and having a single focus point on the target.

Electrical Umbrella Fan.

(No. 1,148,372; issued to Sylvester Chrystow, assignor one-half to Ludomir Dolkiewich.)

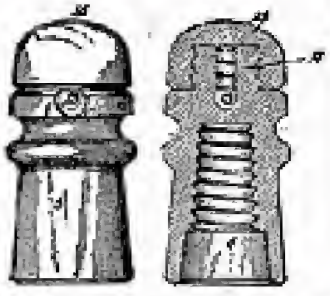
This invention covers the use of a small, electrically driven fan, as perceived and is to be utilized in umbrellas. The fan blades are driven by a small shaft, passing upward through the umbrella handle and



stem, as is evident. This shaft connects with a miniature electric motor 28, which receives current from a small flashlight type battery 29, in the handle of the umbrella. A push button 31 controls the battery current to the motor. The expense in making up this arrangement and also considering the great efficiency, and especially the small "horse powering power" in this case, does not seem in warrant; as all the expense in making up such an arrangement.

Electrical Insulator.

(No. 1,146,231; issued to Silvester Nunn.)



A new and simple form of insulator, intended to be made up of porcelain or glass. This insulator, as the specification states, is very efficacious for telegraph and telephone lines, especially; and the wire is not clamped in same, but is simply retained in the insulator in the slot 32. A threaded cap 35 screws down on a stud 34, forming part of the insulator base 5. Thus the wire once placed in the slot is cannot get out of wire. The patentee claims that a long length of wire (even a mile or more) can be tightened up without touching any of the individual insulators along the line, due to this novel construction.

COPIES OF ANY OF THE ABOVE PATENTS SUPPLIED AT 10c. EACH.

Phoney Patents

Under this heading we will publish hereafter electrical or mechanical ideas which our clever inventors, for reasons best known to themselves, have as yet not patented. We furthermore announce the grand opening of the

PHONEY PATENT OFFIZZ

For the relief of all suffering daffy inventors in this country as well as the entire universe.

We will revolutionize the Patent business immediately and OFFER YOU THREE DOLLARS ($3.00) FOR THE BEST PATENT. If you take your Phoney Patent to Washington, they charge you $1000 for the initial fee and then you haven't a smell of the Patent yet. After they have allowed the Patent, you must pay another $1000 as a final fee. That's $2000!! WE PAY YOU $3.00 and grant you a Phoney Patent in the bargain, so you save $1997!! When sending in your Phoney Patent application, be sure that it is as daffy as a lovesick bat. The daffier, the better. Simple sketches and a short description will help our staff of examiners to issue a Phoney Patent on your invention in a jiffy.

PHONEY PATENT OFFIZZ

PHONEY PATENT ALMOST AFFIRMED BY I. M. A. NUT

"No. √ 69512." ELECTRO-MECHANICAL NURSE Applied to Feb. 37, 1925.

Specifications Overlooked

TO those unconcerned and who care not, let it be known that I, myself, unassisted and alone, have invented a peculiar worthyful and valueish apparatus to alleviate and circumnavigate the multifarious troubles of the housewife.

This invention has the full sanction of Mr. Roosevelt in his great crusade against race suicide, and I feel that I am to be heralded as the Saviour of the race. 'Tis true that the canine included in the design is subject to more or less torture for the time being. However, I expect shortly to be able to improve on this detail.

The operation of this contrivance is as follows: The baby (1) wakes up and, not seeing its mother, starts to cry. (The mother no doubt is operating the wireless telephone, back-fence type.) The voices actuate the microphone (2), which is connected by wires (3-4) to the 'phones (5) clamped on the ears of the dog (6). The dog, naturally, knowing something is wrong, runs from his kennel (7), pulling out the sliding bar (8), to which he is fastened by means of the chain (9). This closes the switch (10), thus completing the circuits containing batteries (11), motors (12-13) and the electric phonograph (14).

The motor (12) rocks the cradle (15) by means of the arm (16) attached to an eccentric on the motor shaft.

Simultaneously motor (13) starts the double compound duplex air-cooled pump (18), to which it is connected by means of gearing (17). The pump forces air through pipe (20) into milk tank (19), which in turn forces the milk through pipe (21) and flexible tubing (22), thus supplying the baby with a stream of milk.

At (23) is shown the adjusting screw which regulates the delivery of the milk to the baby, and by this means it is possible to regulate the flow to give anything from a steady, forceful stream to a fine spray.

The phonograph (14) contains a record made by the mother of the child. A photograph of the mother (24) is placed in front of the phonograph, so in case the baby should look in the direction of the voice it will see the photograph and, thinking same is its mother, will instantly fall asleep.

A safety valve (25) is used to adjust the pressure in the milk reservoir.

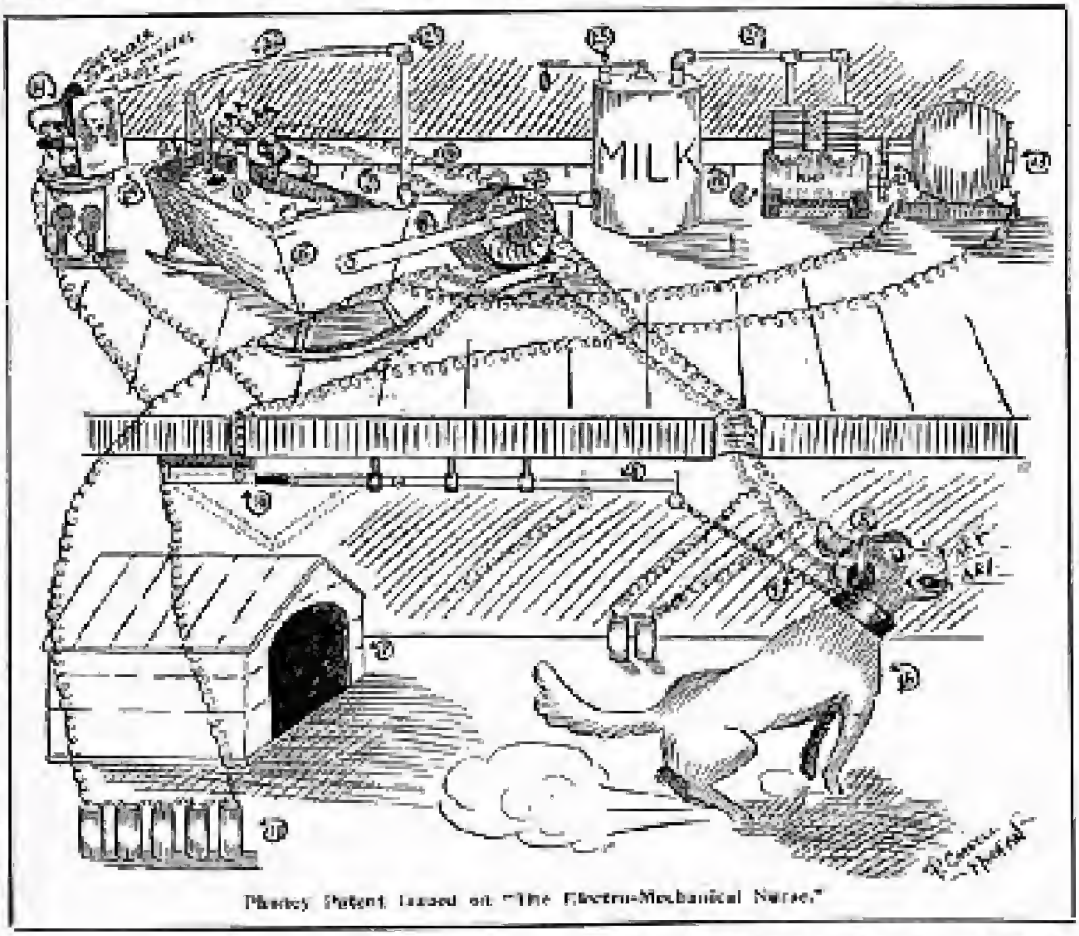
The dotted lines show the position of the switch before the dog leaves the kennel, and when the baby stops crying the dog goes back to the kennel and the switch opens again, thus saving milk and current.

All rights to this invention are retained, including foreign and domestic motion picture rights.

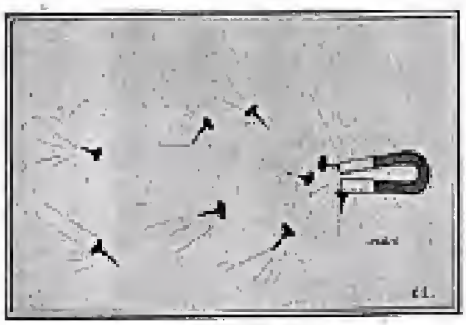
In testimony thereof I have riveted and soldered hereto my seal, this day, date unknown and unstated, in this slow old burg of Earthquakerdom. I. M. A. NUT.

By his Attorney,

Witnesses: *P. Carroll Mcanon, Philadelphia, Pa.*
G. O. Beatit,
Den Ynburden, 2d.



Phoney Patent Issued on "The Electro-Mechanical Nurse."



"In-Corse Tacks."

SOLUTION OF "PHONOGRAPH" CODE PUZZLE IN SEPTEMBER ISSUE.

This Way, Boys, to the Maze, Follow Me Around, Now Please Don't Get Dizzy, Soon We'll Be There. Ooh, Such a Headache!

BLAME GERMAN WIRELESS PLANT FOR RAIN OR DROUGHT.

No matter what happens, the German wireless station at Sayville, L. I., is to blame, Sayville folk think. Last year, when there was a memorable drought, they said the electrical effects absorbed all the moisture and made Sayville dry as a Saratoga chip.

Now that the skies have bathed Sayville about every second day all summer, the German wireless station is again to blame.

AN ELECTRIC SQUIRREL?

A German who had not been in the country very long walked into a drug store one day. The first thing that caught his attention was an electric fan buzzing busily on the soda counter. He watched it with great interest for some time, then, turning to the clerk, he said:

"Py golly, dat's a lifely squirrel vot you got in dare, ain't it?"

QUESTION BOX

This department is for the sole benefit of the electrical experimenter. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail.

ENERGY EQUIVALENT OF 1/12 H.P. ENGINE.

(328.) P. Efermeyer, Cleveland, O., asks about the equivalent power or energy in foot pounds of a 1-12-horsepower engine.

A. 1. A 1-12-horsepower engine is capable of doing 2750 foot pounds of work per minute, thus it will lift that number of pounds one foot per minute, or another weight an equivalent height in that space of time.

ELECTRICALLY DRIVEN BICYCLE

(329.) Byron S. Human, Niagara Falls, N. Y., inquires about the practicability of utilizing a ⅛-horsepower battery motor for propelling a bicycle.

A. 1. This is quite impracticable. In the first place, ⅛ horsepower is insufficient to drive a bicycle and, furthermore, it requires an excessive weight of lead storage cells for any appreciable length of run with the proper horsepower.

Experiments are being carried on with motorcycles driven by electrical power, but so far nothing really practical has come of it.

WIRELESS QUESTIONS.

(330.) Wynn Boydan, Medina, O., asks several questions on radio matters.

A. 1. We cannot understand why the mere adjustment of a detector should necessitate such a great change in the inductance used in tuning.

You must have made some change in the capacity of your aerial to cause this marked effect, as detectors have little or no effect on the wave length.

Your suggestion for a new loose coupler is not exactly new and possesses no advantage over modern types. In winding the two coils so close you practically destroy all selectivity, which is the secret of the operation of the loose coupler. The plan will work, we admit, *and the coupler will produce louder signals* under certain circumstances, but for all around work use your present loose coupler.

The adapted method of shortening the wave length of an aerial is to connect a variable condenser in series. This is done on shipboard when the "distress signals" are sent out and all stations with the long wave require a series condenser to pick up short waves. We know of no instruments which will eliminate excessive static without also weakening to a certain extent the wireless signals. The only way this static may be done away with to an appreciable extent is to shunt a variable condenser across the coupler secondary, which dissipates considerable of the static.

SELENIUM CELL CURRENT.

(331.) L. C. Yeaw, North Adams, Mass., wishes to know the current that will pass through selenium cells.

A. 1. The current that will pass through selenium cells varies, of course, with the resistance of same, and the cells regularly furnished all have different individual resistances in most cases.

At any rate the current in amperes is readily deduced from Ohm's law, which states that the current in amperes equals the volts divided by the resistance in ohms. Some of these cells "drop" as low as 4,000 to 5,000 ohms in the light.

PERPETUAL MOTION?

(332.) Harold Jackson, Woodbine, Ia., proposes a scheme whereby (apparently) an electric motor is to be operated from a storage battery, while the motor in turn drives a dynamo that is supposed to recharge the battery.

A. 1. We know of no arrangement, such as we presume you have in mind, whereby an electric motor can be operated from a storage battery, and which motor will in turn drive a dynamo which recharges the battery. This is physically impossible. Remember that the electrical and mechanical losses encountered in overcoming the frictional and resistance effects reacting on such a system absolutely precludes any possibility of "making" energy, resulting in what would really be "perpetual motion."

RE SMALL RADIO AERIALS.

(333.) Patrick J. Leary, Boston, Mass., inquires about indoor aerials.

A. 1. We understand that the special indoor aerial described in the March, 1914, *Electrical Experimenter* works very well, as used by the French engineer, Mr. P. Doane.

As to your second query on small size aerial, which you propose to erect on top of a piazza roof, we are of the opinion that this will be all right for short range work undoubtedly, and you would not gain anything by placing the wires in this aerial any closer together than about 1½ feet.

TRANSFORMER QUERIES.

(334.) J. Glancy, Mars, Pa., asks several transformer queries.

A. 1. A closed core wireless transformer made up from two ½-K.W. (E. I. Co.), No. 5089 coils, as you suggest, would have a capacity of most probably in the neighborhood of ½ K.W.

A. 2. The No. 5089 coils give about 10,000 volts apiece, and if two of these are used in making up the closed core transformer the secondaries should be connected up on multiple.

A. 3. The difference in voltage ratio in the transformer as you mention would have no effect whatever on the primary frequency, or, rather, the frequency transformation through the transformer, the *secondary* frequency in any case being identical to that of the primary in cycles per second.

TRANSMITTING CONDENSER QUERIES.

(335.) K. K. Knoell, Mars, Pa., asks several questions on radio transmitting condensers.

A. 1. Undoubtedly the E. I. Co. No. 589 condenser is correct as regards its electrostatic capacity in M. Fs., which, of course, corresponds to the value as given in their catalog. The highest capacity is obtained when the metal rod is pushed through all of the switch posts.

A. 2. The condenser you have should give ample capacity for your wireless transmitting outfit with rotary spark gap, and the best capacity to use in the rotary spark gap oscillatory circuit should be found by varying the condenser switch until the maximum radiation current is obtained on hot wire ammeter in series with the aerial, etc.

Regarding the formula as cited in the "Electro" *wireless course* for the proper capacity of a wireless transmitting condenser this is used in the regular way for a rotary gap, excepting that function "F," or the frequency value, is taken (for rotary gaps) as one-half the number of sparks per second given by the rotary gap. This, of course, you can readily deduce from the number of points on your spark wheel and the speed of the motor. If no rotary spark gap was used in your set then the function "F," or the frequency, in the capacity formula under discussion would be taken to mean the frequency of the alternating current in the primary and secondary circuits of your step-up transformer. This considers that there will be two sparks per cycle of current.

The rotary spark gaps usually cause the

condenser capacity, used in the spark gap oscillatory circuit, to be much reduced, as the spark frequency is, of course, raised very appreciably. Four hundred to 500 sparks per second are quite common with such gaps. For best results with such gaps a synchronous A. C. motor should be used to drive same, of course, so that the sparks will take place at regular periods with relation to the rise and fall of the alternating current wave in the primary and secondary circuits of the transformer. However, non-synchronous rotary spark gaps are widely used and very good results are obtained with them, all things considered.

5 K.W. TRANSFORMER ON 3 K.W. ALTERNATOR.

(336.) R. A. Bawles, Columbus, Ga., has a regular lighting type a.c. transformer and wants to use it for wireless transmitting purposes.

A. 1. If your 5 k.w. transformer of commercial pattern is of the high voltage type, giving 10,000 to 15,000 volts, it will be serviceable for radio transmission purposes.

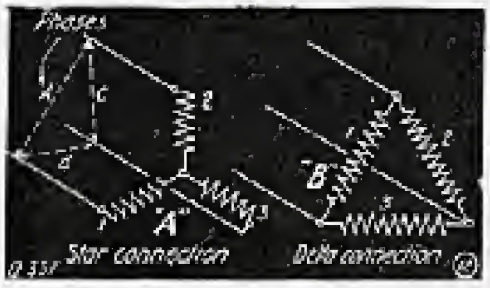
You could not, of course, operate same at full activity with a 3 k.w. alternator, but if the voltage of the a.c. dynamo and the transformer primary correspond, you will get your secondary voltage correctly; but the net output of the transformer will be controlled by the output of the a.c. generator naturally.

It is possible to use lower secondary voltages from the transformer than those above mentioned under certain conditions, and this matter, of course, is something we cannot speak definitely on, as you do not state what secondary voltage the transformer gives.

A. C. HOOK-UPS AND AUDION ACTION.

(337.) John B. Moore, Downsville, N. Y., asks about three-phase "star" and "delta" connections.

A. 1. By the term "star connection" in alternating current work is meant that connection used for three windings on a three-



Alternating Current Circuit Hook-ups, at "A" the Star Connection; at "B," Delta.

phase alternator, motor or transformer, whereby the three windings, when hooked up, appear as in diagram A herewith, which resembles a star, as you will note.

The other connection widely used for similar purposes in alternating current work is that known as the "delta," shown in sketch at B.

A. 2. Relative to the ratio of turns in the primary and secondary windings on the magnetic detector; there are several hundred turns on the secondary coil which would have the same resistance (approximately) as the head 'phones used in connection with same, and the primary winding contains several dozen turns of heavier wire.

The secondary is usually about No 32 or 34 silk insulated magnet wire and the

primary about No. 24 silk or cotton insulated magnet wire.

A. 3. The principle upon which the Audion detector operates is that of causing a variation or change in the absolute value or strength of a stream of electrons. A variation in this stream of electrons (as produced in the Audion bulb by the incandescent lamp filament in same) is created by a *trigger* action. This *trigger* action is carried out in practise by means of a wire grid and a metal plate placed in the proper position about the incandescent filament. The grid and the plate are connected up to the Hertzian wave circuits of the radio receptor or receiving set. The incoming wireless signals in the form of Hertzian or etheric waves thereby cause a change in the electron stream produced in the Audion bulb, and this variation in the quantity of electrons allowed to strike the plate in same is registered in a pair of sensitive telephone receivers connected to the plate in the Audion bulb.

RADIO OPERATOR'S SALARY.

(338) M. H. Chapman, Baldwinsville, N. Y., asks about the demand for radio operators and the remuneration.

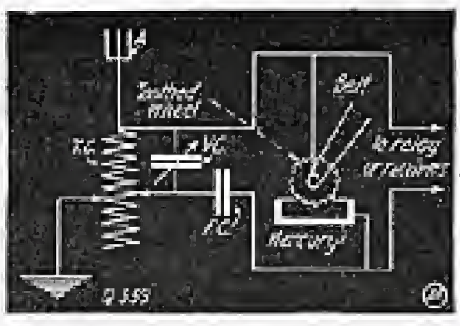
A. 1. There is at present a good chance for wireless operators, especially in view of the great demand created owing to the European war, which has taken many operators from this side of the world, and thus there are numerous openings both here and abroad.

On the average, a ship radio operator's salary is approximately $35 to $40 a month in most cases, which includes board and medical attendance as well as berth.

Land operators get from $75 to $125 a month, depending upon the station they are appointed to, and in most cases a percentage or bonus is paid on the number of messages handled by the operator, which on shipboard of course depends a great deal on the personality and abilities of the operator himself.

LODGE-MUIRHEAD MERCURY COHERER.

(339.) L. Bosserman, Pleasanton, Kan., is interested in the Lodge-Muirhead mercury coherer.



Mercury Coherer Hook-up.

A. 1. Concerning the construction of a Lodge-Muirhead mercury coherer, the brass wheel used in same may be about 1 inch or more in diameter, or even less, and the number of teeth is immaterial. It is rotated by a belt or otherwise at fair speed and the teeth of the wheel should just barely touch the mercury.

This adjustment, of course, is very easily ascertained when trying out the detector in the regular wireless circuit. The rotating tooth wheel should be movable vertically on a slide or else the mercury cup should be adjustable as to height.

Diagram is shown herewith for the connection of this mercury coherer and regular tuning coil, condensers, etc. It has a receiving range on par with other coherers.

A. C. GENERATOR DESIGN.

(940) Fred V. Bechtold, North Manchester, Ind., asks several questions on alternating-current generator design.

A. 1. In reference to your small alternating-current generator, the armature volts developed by same is dependent upon three main factors, viz.: upon the flux in lines per square inch of field-pole cross-sectional area; upon the number of armature conductors per slot (and total conductors, of course), and the revolutions per minute at which the armature is rotated.

You will thus see how it is possible to increase the voltage on your alternator by varying any of these factors. If you desire to keep the speed of the machine the same, and also the number of the armature conductors, then you have only one alternative, which is to increase the field-flux density per square inch. This means that more powerful magnet coils must be used in the manner you suggest, and it is doubtful whether there is room on the field frame to do this.

We would refer you to any book on the subject of dynamo machine design for the data you desire, and several good books on this subject are handled by our book department. You may use a storage battery for exciting the field as you mention.

In changing your field winding for low voltage, the cross-sectional area of the copper wire for the coils is increased proportionately as the direct ratio of the new voltage compared to the original voltage rating for which the coils were designed. Also for the low-voltage winding a proportionately less number of turns would also be used.

RESISTANCE AND DAMPING.

(941) J. L. Green, Roger, Man., Can., asks several questions on damping, resistance, etc.

A. 1. The matter of loose-coupler wave-lengths was explained somewhat in the September, 1914, *Electrical Experimenter*. The primary and secondary windings of the loose coupler when shunted by variable condensers are considered as distinct oscillatory circuits, and the regular wave-length formula is applied to them for general calculations.

We would suggest the ⅜-inch thickness of hard rubber for the small switchboard you mention. The reason why, as you mention, some text-book writers and others often suggest loose couplers for wireless work having a comparatively small number of turns to be counter-balanced by condenser capacity in tuning oscillatory circuits, is due to the fact that if a great number of turns are used in the coils there is also a high ohmic resistance encountered.

This directly affects the "damping" of the circuit, of course, as the greater the ohmic resistance of any oscillatory circuit the higher the "damping," and vice versa.

This relation between the resistance of the circuit and the damping is observed from the following formula for this function as cited in Commander S. S. Robinson's "Manual of Wireless Telegraphy for Naval Electricians" (1913 Edition). The formula is:

$$d = \frac{R}{2nL}$$

where, d = damping of any circuit.
R = total resistance (high frequency value in radio circuit, of course) in ohms.
n = frequency of oscillations in circuit.
L = self-induction of circuit in Henries.

USE OF TWO LOOSE COUPLERS.

(342) George Meister, Newark, N. J., asks for hook-up for two loose couplers in a radio receiving station.

A. 1. Diagram is given herewith for connection of two loose couplers, with the other usual instruments. In this way the second loose coupler serves as a duplex loading coil in both primary and secondary of the second coupler with a wide range of coupling.

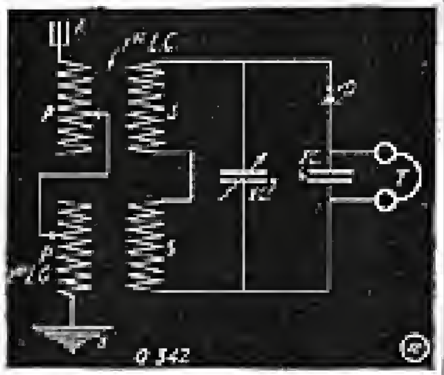


Diagram for Two Loose-Couplers.

TESLA COILS FOR RADIO WORK.

(343) Fred Kessler, Springfield, Ill., speaks of using a Tesla high-frequency coil for radio-telegraphic sending circuits.

A. 1. This is not practical and it is never employed when the usual form of Tesla coil is considered. Of course, every wireless transmitting set constitutes a special form of high-frequency Tesla or Oudin coil, but the ratios of the primary and secondary windings of these wireless high-frequency coils is many times lower than those existing in regular Tesla transformers used for demonstration and experimental work.

A. 2. The matter of aerial wave lengths was covered completely in an exhaustive article which appeared in the February, 1915, issue of *The Electrical Experimenter*. Copy of same may be procured from the publishers, prepaid, for 10 cents.

Roughly, it is: The wave length is equal to four and a half times the length in meters of the aerial wire plus the length of lead-in and ground wires.

RAISING DYNAMO POTENTIALS.

(344) William L. Crawford, Lima, O., wishes to know if he can procure a transformer to raise the voltage of his type "SS" 6-volt, 4-ampere direct current dynamo, and thereby the output also.

A. 1. We do not know of any transforming device of the nature you mention for increasing the voltage developed by a dynamo such as the Knapp type "SS" machine.

You would not gain anything by such a transformation or boosting of the voltage, as of course the net energy will be reduced by such a transformation, as no machine operates at perfect efficiency. If you rewind the dynamo to give a higher voltage then the amperage will be less than it originally was. The watts (volts X amperes) will be roughly the same.

STORMS TIE UP WIRELESS.

Because of equinoctial storms, the Atlantic Communication Co., which maintains the wireless station at Sayville, L. I., has announced that until further notice it will be unable to accept any private messages to Nauen, near Berlin.

PATENT ADVICE

Edited by H. GERNSBACK

In this Department we will publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Questions addressed to "Patent Advice" cannot be answered by mail. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

DESIGN PATENTS.

(19) H. B. Meadowcraft, San Antonio, Tex., wants to know what a design patent is, and what it costs to obtain one.

(A.) Design patents may be granted for any new ornamental design or article of manufacture. For instance, you might design a fork or spoon which has a new ornamental design which might be a flower or any other pattern which has not been used before. In order to keep others from copying the design, one applies for a *design patent* by submitting the design to the patent office. Design patents may be for any new distinctive design or ornaments which may be adopted on silks, fancy fabrics, cut glass, metals, emblems, jewelry, pictures, shapes and almost every other article of manufacture. If a design patent is obtained, the patentee has the right to mark the article patented which gives notice to his competitors that the same design must not be used by others.

Design patents are granted for three and one-half, seven and 14 years, at the option of the applicant, but it cannot be extended at the expiration of the period for which the original patent was granted.

The Government fee for three and one-half years for a design patent is $10, for seven years $15 and 14 years $30. Full fee must be paid at the time the application is filed. To this must be added the fee which the patent attorney will charge for his work in preparing the specifications and drawings. These fees vary from $25 upwards, all depending on how much work is to be performed.

WIRELESS TELEPHONE TRANSMITTER PATENTABLE?

(20) I. Rosin, Cincinnati, O., sends in a sketch and description of a new wireless telephone transmitter which our correspondent claims can carry very heavy currents. He wishes to know whether the invention is practical and patentable.

(A.) The invention presents nothing not known so far, and while a patent might be obtained on some technical points, we doubt whether the device is satisfactory at all, for it is nothing but a relaying scheme whereby the microphone operates a relay system which actuates another large capacity form of microphone. It does not present a good solution of a heavy current carrying microphone such as is desirable in wireless telephony.

EMPLOYER AND EMPLOYEE ON PATENTS.

(21) H. Cabot, Boston, Mass., wishes to know if an employer is not entitled to the invention of an employee if the invention has been made on the employer's premises.

(A.) An employer merely by employing an employee is not entitled to the invention of the employee unless there is an express contract to assign it to him. In other words, if no contract exists between the employee and the employer whereby the former is to assign his patent right to the latter, it will be the property of the original inventor.

COST OF PATENT IN UNITED STATES.

(22) Hamilton B. Lancaster, Lynn, Mass., wants to know what the Government fee is for a simple invention in the United States.

(A.) When you apply for a patent of your invention there are two fees, the first Government fee when applying for patent being $15. When the Government has finally allowed the patent, a final payment of $20 must be made to the Government before the patent can be issued. In other words, the total fee that the Government requires on any patent is $35. Of course, this is only the Government fee and does not include the fee of the patent attorney who prepares the papers, drawings, etc. Usually such a fee to the patent attorney varies from $25 upwards, all depending on how much work has to be performed, how many patents must be looked up, and authorities consulted, etc. An ordinary patent with one sheet of drawings and specifications that are not too complicated will usually amount from $25 to $40 with the average patent attorney.

CAN SWITCH BE PATENTED?

(23) Newell M. Ferris, New York, has sent in a drawing and explanation of a new flush switch, and he wants to know whether we would advise him to patent it, also if there is a demand for such a switch, and whether he ought to submit it to some electrical manufacturing company in order to get financial aid for patent.

(A.) While the device submitted is unquestionably novel, and while we think that a patent might be obtained upon it on account of the constructional details, we do not think that it would be worth while to do so, as it appears to us that the device is entirely unpractical and has several features that make it particularly undesirable. The biggest objection is a sliding movement covering quite a little range and a necessarily large hole which thereby is necessitated in order to move the handle back and forward.

We do not think it would be passed by the Board of Fire Underwriters in its present shape and therefore would be valueless.

ABOUT TRADE-MARKS.

(24) A. B. McCann, Los Angeles, Cal., inquires about trade-marks, where used and how obtained.

(A.) A trade-mark may be registered by an individual, firm or corporation in the United States or in any country granting similar privileges to citizens of the United States when used in commerce with foreign nations, provided it is a proper

subject for registration.

Briefly, a trade-mark is a particular or distinctive design by which the goods of the owner are distinguished from other goods of a similar class. No geographical names or insignia of the United States, municipality, foreign nations or marks which are descriptive of the goods upon which they are used can be trade-marked. No emblem of a fraternal society can be used. The meaning of "descriptive of the goods" is that, for instance, you could not obtain a trade-mark if you were a manufacturer of electrical lamps, and you wanted to trade-mark a picture of the lamp. This would be held as a trade-mark descriptive of the goods. You might obtain a trade-mark of your own name if presented in a distinctive manner providing it did not conflict with any already existing similar name.

In other words, a trade-mark is nothing but a seal which is used in order to brand or distinguish your goods from other goods. It is also necessary that once a trade-mark has been obtained, it cannot be changed in any way. This is an important thing to consider and should be very carefully weighted before application is made, for no change can be made without effecting the validity of the mark.

IS RADIO SCHEME PATENTABLE?

(25) S. Beecher, Campbell, Tex., sends in a sketch of a device to control machinery on a small boat by radio, and wants to know if it is patentable.

(A.) Nothing new is contained in the idea; as a matter of fact, similar schemes have been shown repeatedly in this magazine, and any text book containing some chapters on radio telemechanics will show a variety of such devices.

We do not think it is possible to obtain a patent that is worth while on this device.

AN INGENIOUS LAND TORPEDO.

(26) William E. Egan, Troy, N. Y., submits an ingenious torpedo which is supposed to move under its own power from one trench to another. When arriving at the enemy's trench several hundred pounds of gun powder are supposed to be exploded at any desired time by means of a flexible electrical cable attached to the machine.

(A.) The idea is certainly novel and to our knowledge nothing like this has ever appeared in print so far. While there are several objections to a scheme of this kind, it might prove of real use to countries at war if all the details were worked out fully. One of the main objections of the invention in its present shape is that it is too vulnerable, in other words, even a small shell when shot at the machine would not only wreck it but blow it up, and if this happened near the trench from which it had been sent it would prove as deadly to the sender as to the enemy. We think the invention is patentable, but we would suggest to cover the machine with an inverted "bath-tub" shape armor protector in order that a shell fired from the enemy will not wreck and destroy the machine before it reaches its destination. We would advise our correspondent to get in touch with one of the patent attorneys to see what has been done in this art before.

HOW LONG DOES IT TAKE TO GET PATENT?

(27) Hamilton Brown, Springfield, Ill., claims he has invented a new electrical bell on which he feels sure that a patent will be granted. He wants to know how long it will take him to obtain a patent once he has made application.

(A.) It is impossible to prophesy how long it will take for a patent to issue once applied for. It depends entirely upon how much work is at hand in the particular department of the patent office, also how fast the applicant's attorney will do the work. It happens not infrequently that a patent takes from six to eight years to issue for the reason that changes of claims, amendments, etc., have been made after the application has been made. Some patents have issued as soon as two months, but such cases are extremely rare.

We would say that the average patent takes from eight months to a year to issue after the application.

SCIENTISTS WILL STUDY STRAY ELECTRIC CURRENT IN THE ATMOSPHERE.

Wireless experts are congratulating themselves on the increased facilities now afforded for studying the by-products of nature's laboratory, namely, "strays" or "x's." The completion of the new and powerful radio station at Yokohama, Japan, not only facilitates wireless communication across the Pacific but likewise opens a broader field for investigation of atmospheric electricity.

Long-distance stations, due to their high power receiving apparatus, are best equipped to give data on etheric disturbances. Scientists located at San Francisco, Hawaii and Yokohama will collaborate to reach a definite understanding of these stray currents.

Dr. W. Eccles is at the head of the investigation, having been appointed by the British Association to carry on the work.

Very little is known about the origin of "strays" or "x's." They were given these names for brevity, about 1887 or 1888, and were more recently called "static." They are familiar to everyone who has worn wireless receivers in one or more of their various forms.

It is natural that we should jump at the conclusion that "strays" or static is due to lightning, but this theory ignores the fact that they may be due to forces exterior to the earth. There is nothing unreasonable in supposing that the sun may send us occasional electric waves.

The formation of spots on the sun or the constant colossal changes of relative position of the various heavenly bodies may give rise to electric waves that reach the earth and cause these disturbances. It is questions such as these that the British Association is to solve, if possible.

Another subject under observation is the part played by the atmosphere in the variations of signal strength, these variations in relation to weather conditions, the time of day and with the position of such freak disturbances on the face of the globe.

RECEIVING WIRELESS MESSAGES WITH ODD AERIALS.

(*Continued from page 294.*)

odd aerials are used inside of a house no results can be had unless the house is constructed of stone or wood. A house containing steel beams or a mass of other iron work will make the use of such indoor aerials out of the question.

We publish these suggestions not as a mere curiosity, but it is thought that any one of these schemes might prove of invaluable benefit in case of emergency. Storms, a fire, sleet, etc., might put the regular aerial out of commission; in that case some of the above-suggested freak aerials could be used to possibly good advantage. Note that most of these odd aerials can be used for sending as well as receiving. For sending purposes they should, of course, be well insulated.

BARON MUNCHHAUSEN'S NEW SCIENTIFIC ADVENTURES.

(Continued from page 248.)

explored on this dead world. Besides, the meteors had become so alarmingly frequent that it would be only a matter of time when one of us would be killed.

"Flitternix wanted to return to earth at once, for he itched to present a lecture to the American Astronomical Society, whose honorary president he is. I, however, had more ambitious plans. I once had looked through the great telescope at the Lowell Observatory at Flagstaff, Ariz. If I live to be a thousand years old I will never forget the glorious sight which then presented itself to my eyes.

"I saw a ball, lighted up dazzlingly at both extremities. I saw great patches of an ochre red scattered over the surface of the sphere and I had seen dark blue areas among the vast ochre patches. Over the latter runs a mass of fine lines, nearly all of them connecting with the white caps at each extremity. Moreover, these fine lines cause one to gasp involuntarily, for they are as straight and true as if laid out with a rule and pencil. More astonishing yet, some of these lines run absolutely parallel with other ones for the whole length of their extent. And more wonderful yet, whenever two or more lines meet in a junction there is invariably a round black point.

"The ball I had been looking at transfixed for a long time was Mars, the nearest planet to earth, then 37,000,000 miles distant from the latter. Prof. Percival Lowell, the greatest living authority on Martian research work, has convinced the scientific world that the dazzling white caps at the poles of this planet are the polar snow fields. The great ochre patches are desert land, while the dark blue areas represent large tracts of fertile land and its resulting vegetation.

"Now, according to well known physical laws, proved beyond discussion, the smaller a body the quicker it will cool off. All planets and their moons once were white-hot like our sun. The smaller ones cooled off first and the larger ones are not cold as yet. Thus the earth, which measures 7,912 miles in diameter, is still red-hot in its interior, as is proved by its active volcanoes. The moon which is but 2,161 miles across, cooled off ages ago. The oceans once filling its beds then filtered down in its bowels, there to freeze solid, for there was no heat to keep the water fluid. Its atmosphere, which was formerly as dense as that of our earth, was gradually blown off into space, till to-day practically no atmosphere remains. Thus the moon to-day rolls on through space a dead world.

"The planet Mars, measuring 4,861 miles in diameter, as will be seen, is only twice as large as our moon and much smaller than the earth. Consequently it must be rapidly nearing its extinction, the same as the moon. Its oceans are already dry, while most of the land is desert. The atmosphere has nearly all gone too, proved by the fact that we practically never observe clouds on Mars through the telescope. But there must be water on the planet as yet, this being irrefutably proved by its polar snow caps. This view is further strengthened by the fact that these caps undergo seasonal changes. As the sun beats down upon them we see first the one, then the other, grow smaller in size, till at the end of the Martian mid-summer the northern one has disappeared almost entirely. During the next hot season the same happens to the southern one. Where has this water—*the only remaining water on Mars*—gone? It cannot have filtered into the interior, for if it had, we could not possibly witness the reappearance of the polar snow fields, every Martian year, as we actually do. Where, then, does the water go?

"Dr. Lowell solved the problem in a brilliant as well as ingenious manner.

"His view—and it is shared by most of our scientists to-day—is that Mars is inhabited by a thinking people, fighting a heroic battle for their existence. Without water, life, as we know it, cannot exist. Now ages ago the shortage of water had made itself felt on Mars. Long before the first cave man appeared on earth Mars had been an old world, where civilized peoples had reigned for centuries. While our ancestors were still jumping from limb to limb among the trees in primordial forests and jungles, the water problem on Mars had become acute. The fertile lands were fast turning into deserts for rains had become more and more infrequent, until they had stopped almost entirely. Furthermore, as Mars is flat without mountains or elevations of any sort, there could not be any natural rivers to convey the water to the plains and valleys as is the case on our world. The Martians, seeing utter extermination staring them in the face, proceeded to save their race. They did precisely the same thing as we are already doing in Western America and the Egyptians are doing in Egypt, namely, irrigation of deserts or semi-deserts on a large scale. Our recent Roosevelt dam in Arizona offers a good example of this. Our engineers on earth have to bring the water to the deserts, precisely as the

Martian engineers must have been doing it for centuries past.

"On earth, however, this is a comparatively simple matter, for here we have rivers and lakes in abundance which can be tapped with ease. Not so on Mars. The only remaining water there is found around the poles; by sheer necessity, therefore, the Martians had to go to the poles for their water supply, and this is exactly what our telescopes reveal that they did. For the long, unswerving straight lines which we see are part of the canals bringing the water down from the poles to the desert land there to irrigate it. So far the Lowell observatory has discovered almost 600 canals, but there are doubtless many more. They criss-cross the entire surface of the planet in every conceivable direction, most of them, however, running due north and south in the direction of the poles. Not only do the canals cross the desert lands, but we see them carried boldly across the dark blue areas which we know to be irrigated vegetation tracts. The fact that the canals run across these areas is another proof that they are not oceans, as had been thought at one time.

"Now the lines which we see running over the planet are really not the canals themselves, but are simply wide strips of vegetation fertilized and kept alive by the water from the canals. The average width of the canals proper Dr. Lowell estimates to be about six miles. There are some of them, however, which are thought to be much wider than this. The length of these canals, however, is stupendous. There are some canals which actually measure 3,400 miles. A great many are over 2,000 miles long. Dozens of them run for 1,000 miles, and nearly all of the canals run in absolutely straight lines.

"The circular black points, mentioned above, which we see almost invariably at the junction of one or more canals, are termed oases. They also represent vast tracts of vegetation and probably contain large cities, farms and so forth.

"It must convince the strongest opponent of Dr. Lowell's theory, when viewing Mars and its canals through a first-class telescope, that these wonderfully straight lines cannot by any possible chance be the work of Nature. Its counterpart is found nowhere on earth nor in the heavens. And if by any chance, for argument's sake, these lines should be of a natural origin, so many of them could not for any conceivable cause join and meet as they do and form these exact circular areas. Their artificial origin is too apparent and cannot be otherwise considered to-day. Dr. Lowell's theory has so far withstood the onslaughts of all opponents, as a matter of fact, his explanation is to-day accepted almost universally.

"But how do the Martians move the tremendous masses of water through their canals? For, as explained already, Mars is entirely level, and water does not flow on a level surface without a "head." Moreover, during one season it must needs flow from the north towards the equator, when the northern polar snow cap melts under the influence of the sun's heat. *During the next season, however, this flow must be reversed* for now the south polar snow cap melts, with a resulting flow of the water from the south to the north.

"But how do the Martians succeed in moving the water? We don't know. Even Professor Lowell is silent on this point. Terrestrial science simply has as yet no; advanced enough to offer an explanation f

"Well, to make a long story short, Fli; ternix and I decided to voyage to Planet Mars. My little astronomical lecture was given solely for the purpose of refreshing

SEE THE IMPORTANT SUBSCRIPTION OFFER ON PAGE 341

your mind as to Mars in order that future reports which I shall make to you from the planet will be better understood by you and your friends.

"If our 'Interstellar' was able to succeed in reaching the moon without mishap, I felt sure that the trip to Mars would not be an unduly difficult undertaking. Flitternix was of the same opinion. We calculated that the intervening 60 million miles separating the moon from Mars should be negotiated by our space flyer within 30 days, barring no accidents. While this may seem like a short time to cover such an immense distance, our speed of 1,600,000 miles a day, or 66,666 miles an hour, is only a trifle greater than [the speed of the earth (65,533 miles an hour) as it travels in its orbit around the sun.]

"We immediately made our preparations and within six hours after I had emerged from the crater, the 'Interstellar' had left the moon.

"And now for a little surprise! No doubt you noted that my voice does not sound the same as usual. You will have observed, furthermore, that I did not stop talking since I started. To break the news gently to you, I am not talking at all! While you are listening to my voice at this minute, I will be some 1,100,000 miles distant from the moon heading towards Mars!

"The explanation? Simplicity as usual!

"Before leaving in our 'Interstellar' we stretched an immense aerial inside of the canyon, the one of which I spoke to you several days ago. As you will remember, I told you then that it was open but a few feet across its opening at the top. It thus formed a long, narrow slit at the top into which there was little likelihood of meteors dropping, which could destroy the aerial. We stretched four wires in all along the inside of the canyon, spacing the strands six feet apart. Each strand is 6,000 feet long in order to give the required long wave length in transmitting as well as receiving impulses between Mars and the Moon, as well as between the latter and the Earth.

"To this aerial I connected my latest invention, by *Interplanetarian Radiotomatic*. It is nothing but an ingenious adaptation of modern tele-mechanics and works as follows:

"When the aerial receives a certain number of equally spaced dashes an ultra-sensitive detector is actuated upon which in turn operates a gas-valve relay. This relay then closes its contacts, which sets in motion the well-known telegraphone, invented by Poulsen. A second ultra-sensitive detector, also connected to the aerial, is in series with the *registering* electro-magnets of the telegraphone; in front of these magnets runs the moving steel wire, on which are then recorded the impulses coming in over the aerial. You will observe that no message can thus be recorded unless the original *key dashes* unlock the telegraphone mechanism. At the end of the message the same number of equally spaced dashes will lock the telegraphone mechanism. The recorded message is now ready for retransmission at any time desired. This is accomplished in a simple manner too.

"I took our 300-day clock and fastened upon it a contact which would be closed at exactly 11 p.m. every night and would be opened again at 12 o'clock midnight. This contact closes a circuit in which is included the telegraphone mechanism. As soon as it starts the steel wire with its recorded message begins to reel off in front of the two *reproducing* electro magnets, which in turn are connected with a special telephone receiver. Thus the telephone receiver will begin to talk its message (If

one was sent during that day) every evening at 11 o'clock.

"But connected to the telephone receiver are several amplifiers, arranged in cascade. The last amplifier is attached to the mouthpiece of the transmitter of my wireless telephone. Thus the weakest recorded talk on the telegraphone wire will cause the telephone of the last amplifier to talk into the wireless transmitter louder than myself.

"Now my 200-day clock every night at 11 o'clock also closes the contacts of a powerful relay, which in turn operates the generating plant of my wireless telephone, disconnecting it at midnight. Therefore when the amplifier with its telephone begins to talk into the transmitter of the wireless telephone, there will always be enough power to transmit it to you on Earth.

"As soon as we arrive on Mars we will in all probability find all the necessary materials to erect a giant Radio telephone plant, and if we succeed we will send daily messages to the Moon, while my radiotomatic relaying plant will transmit the messages to you every night. I might also mention that my ultra-sensitive detector contains two radio-active substances, making the detector such a marvelously sensitive instrument that it will work a set of amplifiers in cascade *when an electric pocket buzzer is operated one hundred and fifty miles away from it, connected to the ground only and using no aerial!*

"You might say: 'Why use the relaying plant on the Moon at all? Why not transmit from Mars to the Earth directly?'

"The reason is that when the weak impulses arrive from Mars, after having traveled from 50 to 60 million miles, they cannot be sufficiently strong to pass through the Earth's thick atmosphere, always charged with electricity and 'static.' It is far better that the weak impulses should operate the relaying plant first and send out from there very strong impulses which have but to travel some 238,000 miles to Earth.

"We tested the plant thoroughly and after we had satisfied ourselves that it would work for at least 300 days I opened the telegraphone circuit and began to register this message to you. It will be the last one which you will receive for 30 days or more. As it must needs take us from five to 10 days to build a transmitting plant on Mars, you need not expect to hear from us for from 35 to 40 days. You might, therefore, commence to 'listen in' beginning with the 35th day from tonight. No message can ever be repeated, for the '*wiping*' electro-magnets of the telegraphone wipe out the magnetic impulses from the steel wire as quickly as they pass the transmitting magnets. Neither can you transmit a message to me, for no provisions were made to relay your messages to us when on Mars.

"I will now bid you adieu, my boy. Think of us during the next 30 days! Good-bye—good-bye......"

There was a silence for some seconds, and as I was still listening awestruck, I was suddenly startled by another voice breaking in:

"Hallo, there Alter, this is Professor Flitterails. How's Yankton? Beastly old town! Was once forced to sleep on a billiard table in the Palace Hotel, as all the rooms were full. The robbers charged me $2.50 for the "room" plus the regulation rate of 50 cents an hour for the use of the billiard table! Mean town, that Yankton! Well, good-bye......"

There was a snapping noise and the rhythmic low sizzling sound stopped abruptly. All was quiet once more.

(*To be continued.*)

THE AURORA BOREALIS OR THE NORTHERN LIGHTS.

(*Continued from page 245.*)

It is possible to produce an artificial Auroral effect in the laboratory, as Fig. 4 shows. Between the poles of a powerful electro-magnet is placed an exhausted glass bulb. When a high-voltage electric current is connected with such an exhausted globe in the manner shown and also when the magnetic flux in the magnets is caused to pass through the bulb, a remarkable change takes place, which has considerable bearing on the apparent action occurring in the Aurora Borealis as seen in nature. The artificial Auroras produced in the exhausted bulb, as here described, take a spiral form, the spirals tending to point toward the magnetic poles. This seems to confirm the theory that the streamers of the Aurora Borealis in nature are composed of electrons, descending to the outer gaseous envelope of the earth sometimes from a height as great as 300 miles. These spiral down, following the lines of magnetic force, toward the poles; the spiral at the same time gradually closing up and decreasing in diameter as the field strength increases. The luminous globe becomes brighter, due to this concentration and the improved conductivity which results; a combined effect of the magnetic and electric fields which are strongest at the poles, also helping to increase the conductivity. In the proximity or neighborhood of the conducting layer the Auroral streamers or rays come to an end, as the electrons or electrically charged particles then return upon their paths and spiral up again.

Regarding the state of the *electrical charge* in the atmosphere surrounding the earth at the periods when the Aurora Borealis occurs it was found by Andree, who made careful measurements with a sensitive electrometer, that before the appearance of an Aurora, the positive electric potential of the atmosphere diminished abruptly and in some cases it even became "negative." This also usually occurs when it rains, but after a rain storm the positive charge in the atmosphere generally returns promptly. When the Aurora takes place, the atmospheric potential takes up as before and quite rapidly a high-positive electro-static value. Thus we see that the Aurora Borealis does affect directly the *electrical equilibrium* of our globe, and therefore it is perceived how it can affect without any question the electrical telegraph lines and wireless systems built by man, and which use, of course, in any case a power which is but an infinitesimal fraction of the vast amount of energy involved in such effects as the Aurora Borealis.

THE GRAVITATION NULLIFIER.

(*Continued from page 257.*)

ing together, drifting as aimlessly as thistledown and all shrieking in terror. Guns and wagons were overturned or walked away by maddened, frantic teams. The whole line as that gyroplane passed over it went into such confusion as only a terrific tornado could have caused.

Cawthorne swept ahead, his orders being to block the railroad. As he passed over the yards at Caliente and put the nullifier into action switching engines lost their traction and either spun their driving wheels uselessly or wobbled off the tracks, piling great loaded cars against each other like bales of cotton-batten. G.N.2 was less than half a minute gliding back and forth over that yard, and it took the enemy four days to restore working conditions.

On again, down the line, stalling the first train but allowing the hundreds of tons

weight of the following train to crash into the first. On again, through the Vegas Canyon, where a half-gale of wind distributed feather-weight moguls and freight cars up along the jagged, precipitous rocky sides of the mountains. Another train of 17 coaches loaded with troops fluttered away—kit complete—across the St. Piedras divide, where it straddled the summit, lying on its side. But, except for some wrenches and sprains, not a man was hurt, for there was not an ounce of weight in the entire outfit, men or cars.

On again, across the wild, arid Tepeguazas plains, where they sent 8,000 of Caballero's Mexican warriors and horses fluttering in the air like dead leaves, and howling to every saint in the calendar—and many who are not there—to save them. On again, over the Allies' headquarters, where the Jap general, Kioki, and his Chinese ally, Lu Kien, were wafted from a council of war, clinging tenaciously to their camp seats, the Jap settling with sadly ruffled dignity on the flat roof of a 'dobe ranch house, the Chinese drifting against the gyroplane, which had circled down to 100 feet, and where welcoming hands stowed him in the frame—a prisoner for General Illington.

In advance of the G.N.2 flew two aeroplanes, from which were dropped the attractor pellets whenever they came in advance of a train or passed an occupied siding. Then, as Cawthorne followed, his nullifier threw these trains into most appalling confusion. At Mirau Nuevas the operation of this influence, helped by a strong breeze, lifted and deposited an enormous ore bin and the terminal machinery of a great aerial cableway along the main line tracks. In four hours the G.N.2 had blocked 300 miles of railroad at over 40 points.

They turned back, following a direct air line over the mountains to Illington's headquarters. Cawthorne reported amid deep and fervid congratulations, and then laid off for a rest. For nearly 60 hours his head had not touched a pillow.

Six hours later—it seemed but six minutes to him—Capt. Berger came to the tent and aroused him, with the news that the general had received an important dispatch from Washington and wished to see him.

"Captain!" exclaimed the general as Cawthorne half staggered into the room, "I felt it necessary to inform you of this at once." He held out a dispatch:

"To Brig. Gen. N. C. Illington, in command of the Fifth Division at Montoya:

"Your report on the work of the Cawthorne nullifiers received. Hearty congratulations. It is advisable that immediate action be taken against the enemy's transports and battleships now in the Gulf of Mexico. You will detail Capt. Cawthorne and his party, with ample escort, to proceed to the Gulf and report to Admiral Young for operation against those ships.

"By order of the President.

"JOHN J. SMITH, Secretary of War."

Cawthorne stared blankly and muttered: "Impossible, general! The nullifier can operate only on land. We have not discovered why, but we know that water is a perfect insulator against the electric zone which counteracts the gravitation. The attempt would be useless! The Navy will have to be depended on to clean out the Gulf—unless—"

"Unless what, captain?"

"Unless I can at once go North to my experimental shops. Did you ever hear of the Poniatowski Arc, sir?"

"Never!"

Cawthorne smiled grimly. "I think that

not one man in a thousand has, although it was discovered several years ago, but suspected only of capabilities for long-distance signaling. "But"—his voice sank into very low, earnest tones—"I know that with the apparatus we have completed in our shops you on land or an admiral at sea would have as full control over the firing of the enemy's guns as the enemy himself has!"

The general dropped back in his chair. "What! Another ghastly invention?"

"Exactly! If I can have leave of absence for ten days—perhaps a little longer, and take Kilroth with me, I think that I can bring you the power to not only countermand every order of the enemy's commanders, but to issue the orders yourself with the certainty that they will be obeyed. The gyroplanes and nullifiers will be here to use if needed again, and Capt. Berger is fully capable of handling them."

The general granted hoarsely: "I've got to believe you, Cawthorne! I've got to! Your passports shall be made out at once."

(The End.)

A POWERFUL ELECTRO MAGNET FOR BATTERIES.

(Continued from page 272.)

N. and S. poles. When the current passes around the coil in a *clockwise* direction (i.e., right-hand), the magnetic pole produced is a South one in a direction toward the reader. Every magnet has two poles of opposite polarity, no matter how small it may be. Unlike magnetic poles attract each other and, conjointly, like poles repel each other, as indicated at Fig. 3 B, where the S. pole of a magnet is attracting the N. pole of the magnetized steel compass needle. The end of the compass needle that points toward the north magnetic pole of the earth is, strictly speaking, the "north seeking pole," or the actual "south" pole of the magnetic needle, as only unlike poles attract each other.

WITH THE "AD MAN."

Along about the time when as a boy I first became a reader of magazines I can remember how people looked upon the adv. found in them. My dad used to tear the advertising pages out and occasionally use them for shaving paper, but most times the stove would get them. Those days when mother saw a department store "ad." she always remarked, "Well they say it's worth $2.50, but I'll bet it isn't worth even as much as they ask, and Lord knows the price is low enough." Those were the views, and the result was that advertising didn't pay as well as to-day, for the confidence of people was lacking, due, of course, to the belief held by many advertisers that people wouldn't believe all they said on paper anyhow, so they had better exaggerate a bit. Well, they did exaggerate all right, but most of them forgot when to quit.

It's different to-day. When Ma sees an ad. now in a good magazine and it looks as though a real bargain is advertised, she sends right off for it, because she realizes that no good magazine would think of carrying the advertisement of a non-reliable concern. Therefore when you see an advertisement in *The Electrical Experimenter* you need have no compunction about sending an advertiser your money, for the publishers of *The Electrical Experimenter* absolutely and unquestionably guarantee the integrity of every advertiser in his dealings with their subscribers.

Read this last paragraph twice—it's worth while, and above all, it means that you can absolutely rely on the advertisement of every advertiser in *The Electrical Experimenter*.

MILTON HYMES.

Scientific Exchange Columns

UNDOUBTEDLY you have at the present time some things for which you have no further use. Do you wish to sell these things or exchange them for something, for which you have immediate use? There is no surer and quicker way to do this than by advertising your articles in these columns. The **very** people, the **only** people, who could possibly have a use for your things read this journal. More than 30,000 interested people will see your ad. It is furthermore the cheapest advertising medium for you in the country. Dealers' advertising accepted in Opportunity Exchange Columns only.

The rates are: One cent per word (name and address to be counted) minimum space 3 lines. Count about 7 words to the line. **Remittance must accompany all orders.**

We reserve to ourselves the right to refuse any advertisement which we consider misleading or objectionable. Advertisements for the November issue should reach us not later than October 5th.

The Classified Columns of "The Electrical Experimenter" Bring Positive Results.

TO SELL.—One telescope, 3 feet long, special lens, good condition. Premo camera, pictures 2¼ x 3 in.; guaranteed; cost $1.50. Both for $1.35 prepaid. Herbert Gabbard, 1739 Pendleton St., Columbia, S. C.

I WILL TRADE a complete wireless set, consisting of the following articles for an Indian or Harley Davidson motorcycle of late model and in good condition: Loading coil, receiving transformer, 3 detectors, potentiometer fixed condenser, 2 variable condensers, spark coil, gap key, magnetic Kellogg-Cabot receivers, telegraph key and sounder and a 75-ohm relay. Address Herbert Ewing, Point Marion, Pa. Box No. 62.

HAVE complete wireless set, racing bicycle, miscellaneous electrical goods, two revolvers. Want motorcycle, or make offer. Will also sell separately. All correspondence answered. Sheldon Gelb, 74 East 116th St., New York City.

FOR SALE—Wireless outfit. Has single slide tuner, electrolytic detector, perikon detector, condenser, two-point detector switch, potentiometer. Mounted and connected. Price, $6, or will sell parts separately. Box 84, Newburyport, Mass.

WILL EXCHANGE—60 Seneca plate camera for spark coil or dynamo. Write to Elmer Drian, 205 S. Market St., Shamokin, Pa.

OLD jump spark coil, telephone generator and receiver, home-made tuning coil, Popular Mechanics 1912, lithograph locomotive model. Will sell or exchange for wireless goods. Ralph L. Kraus, Nevada, Iowa.

FOR SALE OR EXCHANGE—New $7 electric stereoscope, projector; guaranteed; ¾-inch coil, wireless key, loading coil with switches; $4 Murdock variable, spark gaps, powerful battery motor, excellent portable receiving set, stamp collection 1,000 rare varieties. Want Brandes Transatlantic phones and wireless apparatus. Write D. Goodman, 125 Seventh Ave., McKeesport, Pa.

WILL EXCHANGE—A 1-K.W. closed-core, high voltage transformer and case for a Type "E" receiving transformer, De Lanz or Blitzen tuner. All correspondence or propositions answered immediately. John B. Thorley, Jr., 912 College Ave., Fort Worth, Tex.

WILL SELL—3,200-meter mahogany, factory-made loose coupler, new type B Dynamo-Motor cheap; Gravity cells, variable condenser printing press motors; one one spark coil. Write [illegible] Carl Barnekol, 2317 Milwaukee Ave., Chicago, Ill.

FOR SALE OR EXCHANGE—$40 E. I. wireless goods, sixteen foot canoe, $30 expensive kodak, Oliver typewriter, Electric vacuum cleaner, electric fan, Moving picture camera and outfit. Terms [illegible]. Hicks, Mattoon, Ill.

FOR SALE—$37 Cohen Blitzen receiving set in perfect condition, without phones. If interested write Chester Farr, Little Valley, N. Y.

FOR SALE—Fleming valve detector, new, $5, cost $8; 1-inch Bulldog coil, with extra large platinum points, $3.50; No. 1290 Sending condenser, $1.00; polarized relay, 30 ohms, $2.50. Everything good as new. Max Kuhne, 84 River St., Hoboken, N. J.

FOR SALE—½-inch Spark Coil, $1.35, postpaid; Spalding single end punching bag cover, 50c.; both good condition. Paul S. Potter, Kiteville, Iowa.

WILL EXCHANGE—New three slider Tuning Coil, 3 x 12 inches, tested for Arlington, for wireless any line key can render. For Sale, slightly used ½-kilowatt "Blitzen" transformer. Lloyd Green, Pitman, N. J.

WHAT have you to trade? Join the Bureau of Trades. Have over 500 members; trades arranged anywhere. Send for full particulars. 2850 Lee Ave., St. Louis, Mo.

TYPEWRITER—Cost $100. Good as new. Will exchange for $15 Camera, Electrical goods, Books, Mail-order Goods, Musical Instruments, Athletic goods, Bicycle, Automobile Accessories; $18 Cash, or Offer. What have you? Write. Particulars FREE. H. Victor King, Box 1461, Boston, Mass.

FOR SALE—Clapp Eastham Ferron Detector, $5; Manhattan tubular condenser, $2.50; Brownie No. 2 Camera, $2, or what am I offered? Wm. Matthews, care Walbridge & Co., Buffalo, N. Y.

FOR SALE—$15.00 Murdock loose coupler, primary rewound with 140 turns and tapped to two ten-point switches on hard rubber plate. Worth $20; will sell for $10. Murdock tuning coil rewound as 2,000 meter tuner with ten-point switch, sliders removed: $2.50; $18 case of Dietzgen drafting instruments, good as new; $5.50. Edwin L. Powell, 1206 E. Capitol, Washington, D. C.

EXCHANGE—One complete wireless receiving outfit. Want canoe or gasoline engine; prefer motorcycle engine, or what have you? All letters answered. Randall O'Brien, Lewiston, Me.

FOR SALE—Brand new wireless outfit instruments; never used. For particulars, write L. J. Becker, P. O. Box 330, Galveston, Tex.

WANTED—E. I. Co.'s ¼ K.W. transformer coil No. 5031. Must be in good condition. Write, Lloyd Clegg, Corinth, Ind.

HAVE $3 worth of American model builder. Would like good loose coupler, or what have you? William Collins, Gran Ville, Mich.

FOR SALE—X-Ray tube in good condition; dia., 4 inches; will sell for $2.75 prepaid; also step-down transformer, $3 prepaid. Write C. A. Bailey, 708 Dolphin St., Baltimore, Md.

FOR SALE—Name plates, battery, shunt, phones, aerial, ground, on, off; 5c. a piece. Henry G. Aschbrenner, 7637 Carpenter St., Chicago, Ill.

WOULD like to purchase, second-hand, a Ritchie induction coil; 4 in. or 5 in. spark; good condition. Apt. 9, 2102 N St., N. W., Washington, D. C.

FOR SALE—1,200 meter, loose coupler, $2.75; ¼-inch coil, $1.50; fixed condenser, 25c.; plate condenser, 25c.; upright detector, 60c.; Blickensderfer typewriter, $6. C. Stauber, 485 Jersey St., Buffalo, N. Y.

FIRST REMITTANCE of $1 gets a coherer and decoherer complete; never used; postpaid. Instrument worth $2 when new. Wm. D. Wagner, 122 W. 4th St., Duluth, Minn.

WILL EXCHANGE—A 6-volt, 60-ampere Willard storage battery for polarized relay or phonograph, or what have you? Samuel Cohen, 1436 Pitkin Ave., Brooklyn, N. Y.

FOR SALE—A Baker electric coupe in first-class condition with new batteries; three passenger. On account of illness of owner, will sell at bargain price of $300; cost new, $1,800. S. Gorenbeck, 617 West End Ave., New York City.

WANTED—One Bulldog 1 inch or 1½-inch Spark Coil. L. Wiley, 1215 E. Madison St., Portland, Ore.

FOR SALE—Receptor, 75c.; Potentiometer, 75c.; Bells, 75c.; Variable Fixed Condenser, 75c.; Fixed Condenser, 25c.; Galena Detector, 50c. Leighton Gilbert, Bristol, N. Y.

FOR SALE—A complete wireless sending and receiving outfit. Cost me $40. Will send for $20. For complete list of instruments send to following address: Horace Hine, 227 Old Bergen Road, Jersey City, N. J.

FOR TRADE OR SALE—Good D. C. Fan, fourth K. W. Transformer, fine Alto Saxophone, Revolver, etc. Will trade some of these for a good Microscope. Also want Camera, Storage Battery Motor, X-Ray Outfit, etc. Send your list and make offers. L. Smith, Oak St., Ashland, Ore.

BARGAINS—Daily Life of a Railway Mail Clerk, Modern Business Penmanship, New Commercial Arithmetic, Civil Service Manuals 1, 2 and 3. $1 takes entire lot. Mark Kistler, Coalesport, Pa.

FOR SALE—1 De Forest Audion Detector (with new bulb and batteries), $15; an E. I. Co. 3,000-meter loading coil, $1.50; Fixed variable condenser, $1; oscillation transformer, $5; a pair of 2,000-ohm "Government" phones, $5; Variable condenser, $2; a Murdock Mascot Rotary variable condenser, $2; a 3,000-meter navy type loose Coupler, $5. These instruments are in first-class condition. Other apparatus on application. If interested write George B. Todd, Jr., New Albany, Ind.

HAVE one 110-volt D. C. Fan Motor, one A. C. 110-volt, 133-cycle "Emerson" Fan Motor, one Volume of "Practical Electricity and Engineering" and four volumes "Electrical Review and Western Electrician" and some cash. Will exchange for any first-class wireless apparatus; want phones and Audion Detector. What have you? John Kiehl, 121 Leslie Ave., Niles, Ohio.

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